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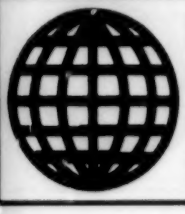

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FACTORY AUTOMATION, ROBOTICS

France: New Shot-Blasting Techniques

Paris L'USINE NOUVELLE in French 2 Dec 93 p 67

[Article by Michel Vilnat: "New Lease on Life for Prestress Shot-Blasting"]

[Text] Development possibilities are opening up for shot-blasting thanks to very innovative techniques.

Shot-blasting, which consists of propelling small metal, glass, or ceramic pellets against the surface of metal parts to increase their resistance to fatigue, is finding wider applications. Teknoson, a new PMI (small and medium-sized enterprise) in the Paris region, has perfected a new method of propelling the pellets to their target. The parts to be processed are suspended in a metal bowl containing a handful of steel pellets. The bowl is connected to an ultrasonic generator which makes it vibrate at a frequency of 20,000 Hz. The pellets thus set in motion will impact the parts in a totally random way at approximately 20,000 times per second. Whatever its shape, the part is treated evenly. It is even possible to shot-blast hollow parts such as inlet tubing, where the shot enters through one opening and exits at the other.

The depth of the process can reach 0.8 mm, depending on the diameter of the pellets, the length of processing, and the power of the ultrasonic transducer. Jian Lu, an engineer at the Cetim materials department who has tested numerous samples prepared by Teknoson, emphasized that "the shot used comes from ball bearings. It is therefore very hard and perfectly spherical. As a result, the surface condition obtained is better than the one achieved with standard shot-blasting where the particles are not always round."

The technique developed by the PMI in Saint-Soupplets (Seine-et-Marne) is patented and was invented by a Russian scientist for the particular purpose of shot-blasting aeronautics parts and gun barrels.

In addition to these functions, the technique has the advantage of being very economical: it does not require much shot, does not need the installation of a shot-sorting system, and does not use up much energy. Prestress shot-blasting applications are very widespread: turbine blades, compressor vane footings, springs, tubing, and so on. Furthermore, shot-blasting can be used on steel or aluminum as well as on titanium. Because of the excellent homogeneousness of the process, thin parts do not warp. To achieve the same result, standard machines must use two nozzles at the same time.

By adapting the shape of the ultrasonic transducer, it is also possible to process hollow shapes such as rifle barrels. A part can very easily be partially shot-blasted if so desired. The surfaces to be protected just need to be covered with masking tape, which will absorb the energy of the shot without transmitting it to the metal. Teknoson specialists are already formulating further developments for their process. For example, by adding a powder to the bowl, parts could conceivably be plated. But in this field, everything has yet to be invented.

Measuring particle velocity is one factor in predicting the efficiency of a shot-blast operation. Until now, this parameter was very difficult to establish. To solve the problem, the Wheelabrator Allevard company, world leader in steel shot-blasting, has joined Helispire, a startup company specializing in measurement systems design, who has come up with the solution: an optical process called Travel.

Yves Lecoffre, head of technology at Helispire and inventor of Travel, explained that "until now, the only technique available was Doppler laser anemometry, a very complex method that is much closer to laboratory techniques than to industrial ones." Not to mention that the laser-based device is costly and must be operated by experts.

At present only enterprises like Snecma have invested in such an installation. Lecoffre pointed out that "our system makes it possible to efficiently measure shot particle velocity by simple means and at reasonable cost (about 120,000 francs)." His method consists of illuminating the measurement area with a rectangular beam of white light. When a particle crosses the beam, it sends the light back to a lens that is placed perpendicular to the light beam. This lens is fitted with a mask featuring two narrow slits of different dimensions. The travel time of the reflected light across the slits gives the speed and direction of motion of the particle. Better yet, by doubling the beam through a semi-transparent mirror and adding two more perpendicular slits, two components of velocity are obtained (one horizontal, the other vertical). The Travel device thus makes it possible to measure particles whose diameter size is of the order of 0.5 mm at velocities between 1 m/s and 100 m/s with a precision of the order of one percent. A computer system collects all the results and calculates an average velocity for the particles. As is only fitting, the first shot-blaster equipped with the Travel system is in operation at Allevard Wheelabrator, but future customers have already expressed interest in a machine equipped in this manner.

Germany: 'Virtual Presence' in Automatic Robot Systems Developed

94WS0171A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 27 Dec 93 p 8

[Article by Scha: "Controls for Robots"]

[Text] Dortmund—Under the direction of Eckhard Freund and in collaboration with the Action Association of NRW [North Rhine-Westphalia] Aerospace-Oriented Companies, the Institute for Robot Research (IRF) of the University of Dortmund has developed a new control concept for automated systems and robots by

employing "virtual presence" methods. The control concept is supposed to serve to make robot and automation systems universally usable. For this purpose, the working environment of the robot is graphically reproduced on the computer screen and the operator can carry out his assignment through the computer graphics with the aid of a so-called data glove. The IRF control technology then sees to it that the activities are carried out in the "virtual world" of the computer graphics—the transporting of objects, for example—are replicated by the robots. Conceivable applications with a commercial background in the space industry are, for example, the inspection and repair of costly geostationary communications satellites. Numerous applications for this "virtual presence" technology are also obvious outside the space industry, in the field of medicine, for example, to provide support for operations.

France's CEA Develops New Robot Prototype

94WS0175B Paris PRODUCTIQUE/AFFAIRES in French 30 Dec 93 pp 1, 2

[Article: "Robsyc Born of CEA Alliance With B + Developpement"]

[Text] The robotics unit of the CEA [Atomic Energy Commission], located at Fontenay aux Roses (Hauts de Seine), and B + Developpement, have developed a robot, Robsyc, capable of repositioning small objects accurately and rapidly. Robsyc is probably the world's fastest robot today over long distances—1.5 meters—owing to accelerations of 8 G, and is capable of handling randomly positioned containers weighing 2 kilograms, lift them by means of suction at the rate of 80 containers per minute, and reposition them in orderly layers at the rate of 8 meters per second. Its precision of plus or minus 0.5 mm is provided by a simple mechanism based on flat belting and capable of four degrees of freedom. B + Developpement (18 persons and annual revenue of 20 million francs) is located in Gemenos, near Marseille. It specializes in "mechanotronics" and works under contract on new designs of materials-handling robots. According to Gilbert Gras, a B + Developpement engineer, Robsyc's capabilities are essentially the result of the very innovative architecture of its command control system. To the classic "process + corrector" system, the CEA has added three model modules: inverse, observer-predictor, and behavior. The combination corrects, in real time, the difference between calculated and actual trajectories, by means of rapid computing cards based on distributed signal processing using industrial PC's. Today, Robsyc is a feasibility demonstrator prototype. In the coming months, B + Developpement will adapt it to multiple-object selective sorting (handling of wholesale pharmacist deliveries), and emboxing (depositing of products in cellular-like container or arrangement of containers) for the agricultural food products industry (fancy boxed chocolates, for example).

ABB Launches Two Robots

94WS0175C Paris PRODUCTIQUE/AFFAIRES in French 30 Dec 93 p 2

[Article: "ABB Robotics Launches Two New Robots]

[Text] ABB Robotics has launched two new robots: its IRB 1400 (5 kg) and IRB 2400 (10 kg). These are the first two products of the new line of robots developed by the ABB group under its customized approach to robotization. They feature 6 axes, operate very rapidly, and follow a trajectory with precision. "We know that the primary demands on the part of our clients boil down to reduced cycle time, the manufacture of a wider variety of products on a small-scale production basis, at a reduced price per unit. They also want customized integration of products, systems, and services. This is the feedback that has prompted us to develop this new line," says Guy Micoulet, president of ABB Robotics France. At the heart of the new line is the all-new S4 command console, which enables the user to rapidly put the robots into operation within his current manufacturing process, without delay, without any specific development of software, and without costly adjustments and fine-tuning. This new line also provides in advance for the needs of the manufacturing industries, through various innovations. The line includes a Windows-type operating system interface that facilitates communication regardless of whether the user is an operator, programmer, computer engineer, or systems engineer. It utilizes its own technology, and its language in the form of interactive dialogue is simple. The command console enables very precise adherence to trajectory at a high speed. Rapidity of movements is obtained through automatic optimization of control. The console utilizes a complete real-time dynamic model of the robot arm, enabling incremental accelerations and higher speeds of the arm. The command system always provides the optimum acceleration regardless of conditions of use; as a function, for example, of the position of the arm within the robot's work envelope, or according to the weight and inertia of the load taken on. The system also uses the robot's mechanical potential to optimum advantage. The duration of cycles is therefore shorter and productivity is improved. ABB Robotics will launch other new products and services as part of the new product line it is developing together with its clients. Its current gamut of products and services provides a platform that can be modified and adapted to keep ahead of the needs of industries beyond the next 10 years. The group posted a 1992 revenue of $350 million worldwide with personnel totaling 1900 employees. R&D accounted for $35 million of this revenue. Its activity in France generated a revenue of 162 million francs with 150 employees.

ABB Robotique - 22 rue du 8 Mai 1945, BP 118, 95340 Persan. Tel. (1)30.28.60.00.

LASERS, SENSORS, OPTICS

Switzerland: Single Atoms Viewed With New Cluster Technique

94WS0134A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 26 Nov 93 p 8

[Article by toz: "Atomic Cluster Formation Facilitates Production of Nanostructures"]

[Text] Frankfurt—Specific production of nanostructures is hardly possible with the masking techniques used until now, if one wants to produce future electronic switches with structural widths below about 50 to 60 nanometers. To be sure, using converted grid-tunnel electron microscopes scientists have been able to place single atoms in a specific spot on silicon surfaces. But this technique is slow, because only one atom at a time can be worked on, and it would be very expensive.

However, new research results by Swiss and North American scientists now indicate that there are various ways to build up metals, oxides or possibly other compounds as well in a controlled manner for functional electronic structures on silicon or metals.

A Swiss group of physicists at the EPF Lausanne (Institut de Physique Experimental, CH-1015 Lausanne, Switzerland) is using a guided separation process which leads to clustering or depositing on various surfaces. The surfaces absorb individual atoms, which by means of very precise regulation of the prevailing substrate and material temperatures gather into larger aggregations and finally into clusters.

In so doing the individual atoms act similar to crystallization nuclei in crystal growing. In these processes the atomic surface structure also plays an important role for the depositing processes, a "shaping, defining" role, so to speak. The physicists describe their work principle as "diffusion-controlled aggregation." In these processes the laws of depositing follow the kinetic behavior of the various materials.

It has been possible in the laboratory to deposit, among other things, several hundred Angstrom-long, strip-like lines of copper atoms on surfaces of palladium foils and cluster-sized silver particles on bases of platinum.

The results by the Swiss physicists are not yet suitable for immediate practical application. But they have discovered principles with which it is now possible to build suitable structures for simple, and later on also more complicated, three-dimensionally conceived, electronic components.

U.S. scientists at the NIST National Institute of Science and Technology in Gaithersburg (Maryland) have taken another approach. They use laser light in order precisely to deposit individual atoms. With their method they were able to build several three-dimensional tracks of chromium atoms on a silicon base, for example, which are a little more than 30 nanometers high and are spaced about 213 nanometers apart.

Right now their method functions with metal atoms which are directly applied with the laser beam on the bases. In so doing the excited metal atoms "ride" on the laser beam, which simultaneously also excites the base, so that when they meet aggregations similar to those constructed in the Swiss experiments are created. This method works quite fast: In one minute it was possible to apply 0.7 nanometers of chromium onto a relatively large surface of 0.4 by 1 millimeter with a laser in the spectral range of 425 nanometers.

For the moment the method permits only application of straight line structures. But the developers are working on being able to produce more complex structures as well. This method has the advantage that it is no longer necessary to work with many steps of lithographic masking processes and considerably more expensive x-ray or ultraviolet light. In the subsequent work one will also use two or more laser beams in order to apply structures from not just one but several materials.

At the moment, the still unsatisfactory stability and relatively uneven speed of the laser beams has turned out to represent a bottleneck. It is believed that this problem can be satisfactorily solved in about two to three years. It would then be possible to produce structures with widths of six nanometers. In this way "nanoelectronic" switches could then actually be produced which are about 100 times smaller than today's microelectronic switches.

Meanwhile, applications have been made for several patents for the laser method. The government institute cannot use these patents itself and therefore wants even now to conclude utilization agreements with interested industrial enterprises which are prepared to participate financially and with manpower in the future development work, reports NIST (National Institute of Science and Technology, Gaithersburg, Maryland 20899, USA).

UK: Polymer, Indium-Tin Oxide Electrodes Improve LEDs

94WS0156C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Dec 93 p 10

[Article by OEL: "Brightness of Light-Emitting Diodes Clearly Improved; Polymer in Conjunction With Indium-Tin Oxide Electrodes; Thin Polyphenyl Vinyl Coating"]

[Text] Frankfurt—Light-emitting diodes (LEDs) are based on the phenomenon of electroluminescence—if several electrons with different energy levels come together, they emit photons. The number of photons released is responsible for the luminosity of the LEDs and that depends on the material used.

In addition to the up to now most frequently used semiconductor materials, since 1990, with a discovery by British physicists and chemists at the University of Cambridge, we have also been aware of organic polymer compounds that are capable of electroluminescence. Up to now, however, they exhibited conversion rates of only from 0.5 to 1 percent, corresponding to 200 or 100 electrons per photon released, which is why they did not give off enough light for practical applications.

A polymer now being used by researchers consists of cyanoterephthalyliden, a terephthalic acid used as a substitute, the manufacture of which is well mastered. It makes it possible to produce LEDs with a conversion rate of up to 4 percent. This results in a very high luminosity given the fact that ordinary electric light bulbs attain rates of only about 10 percent.

The new polymer works in conjunction with indium-tin oxide electrodes that are coated with a thin layer of polyphenyl vinyls (PPV). It absorbs into its conduction band electrons that are injected from the electrode material and the coating.

PPV was the first polymer that the team of scientists discovered. But it exhibits a relatively high electron-conduction band and it could only be made luminescent with a very reactive electrode material like calcium. This is why its practical application was not possible. But, since it attaches itself readily to more stable indium-tin oxide electrodes, this makes possible an effective transfer of electrodes to the polycyanoterephthalyliden.

The developers hope to be able to produce bright displays covering large surfaces and, later, computer monitor screens as well with this new and, in comparison with semiconductor materials, easier to process polymer. This is why they have founded a new company, Cambridge Display Technology, Ltd., for its commercial application. This company is expected to obtain additional capital to work out the production techniques, set up possible production, or assign licenses to interested industrial companies. The scientists want to continue their search for more, similar organic compounds and, in addition, attempt to further increase the power output by improving the coating between the electrodes and the active polymer. For further information: University of Cambridge, Cavendish Laboratory, CambridgeCBS OHE, United Kingdom.

Germany: High-Speed Pulsed Laser Microscope Developed

94WS0170B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Dec 93 p 8

[Text] Pulsed laser beams can be used in many ways for material processing. The effects on the material induced by a laser pulse are produced in a very short period of time and in small areas. Exact knowledge about these effects is important for optimal laser utilization. However, there are two goals in observation. First, the observation procedure must possess high magnification. It should also possess high temporal resolution in order to be able to represent the effects of individual laser pulses. Professor Oleg Bostanjoglo and his colleagues from the Optical Institute of the Berlin Technical University (Strasse des 17. Juni 135, 10623 Berlin) have now developed a high-speed electron microscope (EM) linked with a pulsed laser which possesses the necessary properties. The device makes it possible to depict precisely laser-induced crystallization and vaporization processes. According to Bostanjoglo, large effects can be produced in small target areas by irradiating material with pulsed lasers. The high heating and cooling rates lead to the formation of new phases and structures in the irradiated materials which are not attainable using other methods. The technical utilization of the laser is only in its infancy, but has already led to important applications. These include the boring of very small holes, the labeling of components, the hardening of metal surfaces and employment in digital optical read/write memory. Until now the electron microscope has been of only limited use in the investigation of microscopic effects, since while it is sensitive to structure and possesses high resolution spatially, in conventional use it possesses only low temporal resolution. The Berlin scientists have thus converted a commercial electron microscope into a high-speed apparatus.In principle, rapid-exposure photographs can be made in two ways. In continuous operation the sample is constantly irradiated by the electron beam, that is both during and after the laser bombardment. With the help of a scintillator-storage-oscilloscope combination as a detector the individual phases can then be observed with high temporal resolution. The second possibility is that of producing rapid-exposurejphotographs of laser processing with the help of an image enhancer. These photographs are produced by pulses either from the source of illumination or from the image enhancer.In order to investigate the direct effect of the laser beam on the sample, a Nd:YAG laser is combined with the high-speed EM. The laser*beam pulse is focused on the sample in the EM by a laser objective and a deflecting mirror which has a hole for the electron beam. The laser beam and the electron beam run in parallel in the same direction and thus make it possible to investigate the laser effects in real time in a controlled way. The Berlin high-speed electron microscope makes it possible to take rapid-exposure photographs with illumination times from five nanoseconds. The interval between pictures is between 30 nanoseconds and a few microseconds. Both reflective EM investigations of massive materials and transmission EM observations of thin layers can be carried out. The individual pictures can be combined into a "film" in order to observe the dynamics of laser-induced material transformation. Investigations with the high-speed EM have thus far been directed towards research on crystallization processes in semiconductors, structural changes in metals during laser processing, and laser-induced vaporization of thin layers. These researchers aim to achieve a better understanding of laser processing procedures like removal, alloyage, recrystallization, grain

formation and vitrification. The projects are being supported by the German Research Association.

Germany: New Laser System to Check Chips On-Line

94WS0171B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 29 Dec 93 p 8

[Article by GMN: "Laser Monitor for Checking Coating Thickness; New Laser Systems Monitor Coating Processes On-Line"]

[Text] Frankfurt—New kinds of laser sensors that can be used to inspect materials in particular are currently being developed in the Department of Metrology of the University of Saarland. As Prof. Alexander W. Koch explained, surface structures, component movements, surface rough spots, and vibrations, as well as coating thicknesses and optical constants of thin surface films, for example, can be analyzed with these sensors.

Especially the thin coating technique is playing an increasingly more important role in environmental and medical technology in particular. There is a large number of possible coatings that endow the underlying materials with new properties. Laser measurement techniques have also proven to be very well suited to the examination of optically transparent coatings. With them the laser light on the interface between the surrounding medium and the coating is in part reflected and in part refracted into the coating.

The light fractions interfere with one another, dependent on the changes in the optical path. He further said that, since the difference between the optical paths can only be vaired by a change in coating thickness when the material properties are constant, they have with this technique a sensitive in-situ monitor for the thickness of the coating. The resolution maximally amounts to somewhat more than 10 nanometers.

When two interferometers are combined in a dual-beam experiment, their beam paths form different angles with the surface of the coating. If the coating is thicker, there are different periodicities of both monitor signals. Both interferometers detect the difference between the optical paths with high local resolution at the same point on the coating.

A comparison of both monitor signals also further provides, in addition to the thickness of the coating, the refractive index of the coating. Furthermore, Koch explained, computer simulations of the signal sequences allow for conclusions as to absorption coefficients and the homogeneity of the coating.

France Produces High-Energy Aggregate-Ion Beams

94WS0193C Paris AFP SCIENCES in French 30 Dec 93 pp 7, 8

[Unattributed article: "High-Energy Aggregate-Ion Beams Obtained at IPN [Nuclear Physics Institute]"]

[Text] Paris—Aggregate beams consisting of three to four high-energy electrically-charged atoms were obtained recently by an IPN team at Orsay. These results, according to the IN2P3 (National Institute of Nuclear and Particle Physics of the CNRS [National Center for Scientific Research]), "give France a definite lead in this field."

Using a gold source and the Tandem electrostatic accelerator, the IPN team headed by Serge Della Negra succeeded in producing aggregate beams consisting of three to four atoms, each carrying one positive charge (Au^{+++} and Au^{++++} aggregate ions) and having an energy of 10 million electronvolts [MeV].

Aggregates are assemblies of weakly-bonded atoms (from just a few to a few hundreds) that constitute a special state of matter, the structure and behavior are somewhat similar to those of atomic nuclei. Their chemical reactivity and selectivity make them useful intermediates in catalysis, optics, and electronics. Thus, since the eighties, many laboratories throughout the world have been studying them.

More particularly, aggregates are increasingly considered as a replacement for single-atom ions, to bombard solids. Increasing the projectile mass also increases the energy deposited on the bombarded area. Bombarding small areas (of the order of 100 square angstroms) with single-atom ions would require currents of several megaamperes, but it can be done with heavy polyatomic ions (heavier than iron).

The idea of producing at the IPN aggregate beams with energies of several MeV was formed several years ago; two years ago, it became possible to start the project (Orion-Tandem project) with financial support from the IN2P3, the CNRS and the DRET (Directorate of Research and Technical Studies) of the DGA (General Delegation for Weapons).

The method used at the IPN consists in placing a source of metallic aggregates and its beam-directing line at the center of the accelerator and subjecting them to a 10 megavolt potential. The positive aggregate ions thus created and pre-accelerated to 60 kV are injected onto the accelerator axis and further accelerated to 10 MeV per charge.

At the start, researchers faced two questions: Would the aggregates withstand the acceleration, and collisions with the residual gas during acceleration until they reached the experimental site, 20 meters farther? Experiments performed last year with carbon molecular ions (C60 and C70 fullerenes) made it possible to answer this

question in the affirmative. Apart from that, would the electronic setup withstand the 10-15 MeV breakdowns that may occur within the accelerator? That is the problem that the IPN solved in November.

These experiments also enabled the researchers to observe very important non-linear effects (coherent effects much higher than the sum of the effects of individual constituents) and to observe the transmission of shock waves in matter to a distance of 0.2 micron and over. They are currently studying the alterations of the solid after impact.

According to researchers, these results open new prospects: "Energies of the order of one gigaelectronvolts could be reached with other sources, multicharged molecular ions (with masses of 100,000 and 100 positive charges) for instance, and transferred under a very small volume during a single collision and in 10^{-13} seconds."

MICROELECTRONICS

French Tape Automated Bonding Technology, Manufacture Reviewed

BR0303120094 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 10 Feb 94 p26

[Report signed L.M.: "TAB Adapted for Use in Small Batch Production"]

[Text] Are electronic systems manufacturers interested in the development in France of a TAB (Tape Automated Bonding) process for assembling bare chips onto tape? Asked in a survey that could lead to the creation of a company within two years, this question again seems reasonable given the launch of the market in multichip modules (MCM's) which consist of several very complex bare chips assembled onto the same substrate (for use in military, aeronautical, computing, and telecommunication applications).

Chips on Tape More Reliable

Chips mounted on tape can be tested before they are assembled in the module and thus, even in short production runs, present a considerable financial advantage over bare chips connected by wires or beads (flip-chips) whose faults can only be detected after assembly. According to certain experts, tests on modules containing the most complex chips can result in a reject rate of up to 30 percent. For complex MCM's, assembling the chips onto tape also has the advantage of reducing the limitations placed on the connection pitch by the wire method (currently used for most applications) and without seriously affecting the chip design. Karel Kurzweil, in charge of microassembly technologies at Bull, explains: "The dimples for the connection of the chips on the tape are in the same locations as the pins for wire soldering, whereas bead connection over the whole area of the chip means that designers have to redefine the entire mounting process." Until now, and despite these advantages, the manufacturers of sophisticated electronic systems have snubbed TAB technology. Tape-mounted chips require expertise in a large number of manufacturing processes (tape preparation, putting the dimples on the wafers, mounting the chips on the tape, and assembling the TAB chips on the substrate) and thus require large scale manufacture to amortize all the machinery needed. The difference between the requirements of potential users and the requirements of TAB technology therefore dissuaded many outfitters. It is probable, on the other hand, that the creation of a more flexible structure, such as that envisaged by the general arms directorate [DGA], which would handle the assembly of chips on tape at a reasonable cost even for small and medium production runs, would interest MCM manufacturers.

The participants in the DGA's project know that the cost of the service proposed will be the decisive factor. Mr. Kurzweil, the Bull representative in the DGA project, said: "In the TAB process, the large number of tools needed to produce the tape is one of the drawbacks of the technology for short production runs. You should reckon on between 30,000 to 80,000 French francs-worth [Fr] of equipment for each production series." However, he assured us: "We are currently trying to reduce these costs."

Will Euro-TAB Packaging Become a Reality?

Dassault Electronique and Bull have been commissioned by the DGA's electronics and computing technical department [STEI] to study the contribution that could be made by TAB technology to military electronic systems. The two microelectronics specialists, assisted by other partners in the fields of silicon and tape, will have to produce prototypes to prove the economic viability of this type of component. At the same time, the STEI has surveyed potential users (military and civil) to determine what their future requirements in terms of TAB components will be. The results of the survey will be published in the second quarter of this year. According to Roland Even, manager of the STEI project, between Fr5 million and Fr10 million will be invested in these studies. If the results of these evaluations and the survey are favorable, an industrial structure, christened Euro TAB packaging could be created within two years. It will specialize in the supply of tape bonded chips to civil and military outfitters for small and medium-term production runs. The structure will in particular take charge of tape design and control, the production of the dimpling on the silicon wafers, the assembly of the chips on the tape, and their testing and burn-in. Systems manufacturers will then be responsible for assembling the chips onto the substrate. Roland Even was reluctant to disclose precise details of how this potential company will be structured financially, but he said that it will accept production runs ranging from just a few chips to several thousand, and will initially employ several dozen people.

France: Rapid Prototyping of Digital Signal Processing Chips

BR0303120394 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 10 Feb 94 p24

[Report signed S.D.: "Rapid ASIC Prototyping for Signal Processing"]

[Text] Automatic tools for generating hardware and software prototypes for the emulation of specific circuits—in other words, "virtual" ASIC's [Application Specific Integrated Circuit]—are a relatively recent invention. Quickturn Systems and PiE Design Systems which have now joined forces under the name Quickturn Design Systems, have led the way in this field. The British company Inca (purchased last year by Zycad) has turned the spotlight on digital signal processing applications. Last year at the American DAC show it presented the initial results of its work in the development of systems based on digital signal processors (DSP's) carried out in the context of the European ESPRIT project (footnote 1) (The Retides project. Other participants include Philips, Thomson, EDC/Mentor Graphics, and the Catholic University of Louvain). Continuing with this line of work, Zycad is now bringing to market a family of solutions for the rapid prototyping of specific applications, christened Paradigm RP. The first model in this family is aimed at DSP-based designs. This solution therefore makes it possible to test complex designs based on DSP's even before they are implanted onto silicon. These designs have a degree of complexity ranging from 30,000 to 120,000 gates or more and clock speeds in excess of 10 MHz (usually from eight to 15 MHz, although 20 MHz may be possible in some cases).

Emulation Based on FPGA's [Fixed Programmable Gate Arrays]

The Paradigm RP consists of a software component and a hardware component. The software component is used to draw, partition, compile, check, and debug a logical circuit on a predefined and modular programmable hardware architecture. This hardware component is built around an emulation mother board containing the equivalent of 30,000 gates in the form of Xilinx 4010-type programmable gate arrays. Interchangeable daughter boards can be connected to the main module, enabling combinations of FPGA's, RAM, ROM, DSP's, and DSP cores and forming a part of the emulated system. The company says that it will support a range of daughter boards to cover all of the most common DSP applications.

Zycad is banking on this product to quickly take shares in this rapidly expanding market for DSP applications, more precisely in a segment of the DSP market that the American consultancy Forward Concepts calls FASIC (Function and Algorithm Specific IC) and estimated to be worth $1.2 billion in 1994 and $3 billion by 1997. In addition, Zycad specializes in logical simulation accelerators, fault simulation, and VHDL [Very High Description Language] simulation.

Germany: Miniaturized Electric Engine Developed in Mainz

MI2001151194 Bonn DIE WELT in German 6 Jan 94 p 7

[Article by Franz Frisch: "6,000 Rpm in a Grain of Rice: A 2-mm Motor Goes Into Series Production—Leading-Edge Technology from Mainz"]

[Text] The engine has been running continuously for weeks as a fatigue test, its rotor making 6,000 revolutions per minute. What is so special about it is that it has a diameter of only 2 mm, the size of a grain of rice. It is to be launched in 1994 as the world's first electric motor manufactured using modern microengineering techniques to come onto the market.

Silicon chips first fired information technology, and now miniaturization is also moving into conventional fields such as mechanical and electrical engineering and metrology.

Contrary to what has happened in microelectronics, Europe still has its nose out in front in this technology of the future, which makes it possible to produce a vast range of microscopic components. Over the last 15 years, its inventor, Professor Wolfgang Ehrfeld, has been granted about 50 patents for what is known as the LIGA (standing, in German, for lithography, electroplating, and molding) process.

The first micromechanical motor thus comes not from Boston or Tokyo, but from Mainz, where Ehrfeld set up the Institute of Microengineering (IMM), a 120-strong research corporation sponsored by the Land of Rhineland-Palatinate, in 1991.

Like semiconductor chip circuits, these mini-components are first designed in large scale then projected onto the material in an extremely reduced scale. The three-dimensional structures formed by exposure to parallel x-rays, which are now available worldwide in synchrotron centers (such as DESY [German Electron Synchrotron] in Hamburg).

Simple micromechanical products are already in industrial use: Ehrfeld, who first worked at the Karlsruhe Nuclear Research Center, began setting up the microengineering division at the STEAG AG group in 1988. In 1990, this division turned into the Dortmund company, Micro-Parts, which now has 60 employees and exports microtechnology—to Japan as well. Outstanding examples are its perfectly formed nozzles with diameters ranging from 20 to 100 micrometers for inkjet printers.

The IMM in Mainz goes for more complex applications ranging from a plug for optical communication systems that is only 1 centimeter wide, is easily inserted, and accurately connects 12 ultrathin glass fibers on 1 micrometer, to a device the size of a cigarette packet for measuring thin films on chips. Electronic circuits can even be conjured onto mini-components made of silicon.

The demand for microtechnology solutions, which are on average 100 times smaller than their conventional counterparts, is showing a marked increase: Joint projects with industry in Mainz rose from 11 to 45 in 1993 alone.

Over the three years of the IMM's life to date, Ehrfeld has consolidated its leading position. For example, he has managed to raise the surface quality of ceramic microstructures 100-fold (previous roughness: 3 micrometers, compared with Ehrfeld's current 30 nanometers). Gold-coated diamond membranes give unprecedented precision for x-ray masks—the negatives for lithography. Jena-based Jenoptik GmbH and the IMM have jointly developed an automated machine for producing LIGA structures, the first two models of which have been sold to France and the United States.

As the head of the IMM is aware that the technological lead that it has acquired over the United States and the Far East can only be maintained if research and development reach critical mass, he has established a European network of firms and research institutes in 12 European countries. The EU [European Union] has awarded this joint project a grant of approximately 3.5 million German marks.

Germany: Siemens Develops Ultrahigh-Speed Chips

MI1901122794 Leinfelden-Echterdingen COMPUTER ZEITUNG in German 9 Dec 93 p 21

[Excerpt] [Passage omitted] Alfred Felder and his colleagues have developed a fast chip that breaks the microelectronics sound barrier: Their silicon chip, which measures less than a square millimeter, can process 40 billion bits per second, the quantity of data that would be generated if each of the million-plus inhabitants of a city the size of Munich were to make phone calls simultaneously. The Siemens researchers have set a world record with their 40 Gigabit-per-second microchip: It had previously been considered impossible for a silicon-based circuit to reach processing speeds of this magnitude, with the result that many manufacturers had turned to gallium arsenide, which is costlier and more complicated to work with. Three different processes, applied to the best advantage, brought about this success: transistor technology, circuit design, and metrology. The latest production methods give controlled deposition of extremely thin films precisely where required. Single-crystal semiconductor and insulating films 1 billionth of a millimeter thick can be accurately positioned using this process, which goes hand in hand with transistor technology developments that create high-performance, purpose-structured transistors by depositing microscopically thin semiconductor materials. The transistor technology is complemented by an optimized circuit: "We did not have to reinvent the wheel by any means, as the circuitry principles are not new, but we succeeded in scaling and arranging the components in such a way as to achieve maximum performance," says Felder.

The scientist, who received the 20,000-German mark Philipp Reis Prize for his work, took advantage of his know-how as a qualified high-frequency engineer when developing his high-speed circuit technology. "There are technical second barriers that you have to know. Once you exceed speeds of a few Gigahertz, the structural and measuring techniques have a major impact," he explains.

The chip is still a prototype and is only a part of the complete 40-Gigabit transmission system. Felder and his colleagues are continuing work on the other key electronic components required for data rates of this magnitude. These include circuits capable of converting parallel data stream inputs into a serial data stream. These "multiplex circuits" are a must for feeding large volumes of data into a glass fiber cable.

There are already trial glass fiber network lines capable of transmitting 10 billion bits per second. The expansion of these networks renders high-performance circuits in the switching stations indispensable. The Siemens researchers expect an early breakthrough for ultra-high-speed transmission technology, particularly in data systems and communications.

This means that future circuits and integrated network concepts will have to handle billions of bits per second if they are to be able to transmit this data together—for high-definition television, digital radio, and mobile phones, for instance.

Germany: Eastern Companies Bring Products to Market

94WS0121C Berlin INGENIEUR DIGEST: WIRTSCHAFT & UNTERNEHMEN in German Nov 93 p 34

[Article by USC] [[

[Text] **Invigorated from Crisis**

Electronics specialists from East Germany appear at the PRODUCTRONICA Exhibition with renewed self-esteem. While two years ago they needed only one common display booth, there are now already 15 exhibitors in Munich.

"It required a great effort to gain a foothold on the market" explains marketing manager Ingo Reichel. A little luck played its role too: In 1991, just during the confusion in the aftermath of the turning-point events, the West European manufacturer of GaAs single crystals Wacker closed shop.

This did not help the people in Saxony much at first, their enterprise still being held in trust. "Had we been so far advanced then as we are today, we certainly would have been able to take over the customers by following target-oriented marketing procedures" assesses Reichel. As it was, however, the competition in Southeast Asia

snatched the customers away from us with lightning speed. "Today we must spare no effort to win these customers back."

At the PRODUCTRONICA Exhibition the Elektonikwerkstoffe (Electronic Materials) Ltd in Freiberg displays single-crystal silicon blocks and slices for photovoltaic cells and electronic devices, also GaAs slices for microwave components and for low-power components. This enterprise has developed and made specialty materials for over the past 35 years. As always, in keeping up with developments in electronics, these materials today are silicon and gallium arsenide.

Also Lothar Spaeth of Jenoptik Ltd is now in Munich. Evolving from the former Carl Zeiss combine in Jena, this company could have afforded to send a representative to the previous 1991 PRODUCTRONICA Exhibition already. Spaeth wants to enter not only the European market but also the U.S.A. and Southeast Asia. With a staff of 1,250 highly qualified employees, the enterprise is active in many business areas: microelectronics, sensors, heavy-duty optics, and precision mechanics.

One strength of Jenoptik is development and production of equipment for the semiconductor industry: electron-beam lighting apparatus, wafer steppers, fine-structure forming apparatus for printed-circuit boards and handling systems, also for measuring and inspection devices.

The Jena people are exhibiting in Munich three innovative developments. The DirectPrint 40 is a laser-type direct-lighting apparatus for printed-circuit boards. It facilitates formation of fine structures having an only 40 µm track width on a printed-circuit board. A minifacility for fabrication under Class 1 clean-room conditions is hidden behind the SMIF Lean Robot SLR 150 AF exhibit. The third novelty is the DefectFinder 2000, a wafer inspecting device with which slicing processes can be automatically monitored.

Now, for the first time, the FHR Anlagenbau (Equipment Construction) enterprise, in existence since 1991, represented in the very traditional Apparatus Construction Post Dresden. This enterprise evolved from the Elektromat enterprise. The staff brought with it many years of experience in development and construction of equipment for vacuum and film deposition processes. With this asset, it should be possible to increase the net output from 1.2 million DM in 1992 to 2 million DM in this year already.

The enterprise does not only develop equipment and devices but also takes over services from and handles products of prominent European manufactures. Its current principal area of activity is environment-friendly treatment, modification, and cleaning of surfaces by plasma and vacuum processes. A large-surface sputtering apparatus makes it possible to coat most diverse target surfaces of all materials currently in use. A whole selection will be shown in Munich.

The Feutron Ltd in Greiz (Vogtland in Thuringia), for over 50 years a specialist in refrigeration, climate, and environment simulation engineering, has already installed about 15,000 climatic test chambers all over Europe. It holds 50 relevant patents. This company will demonstrate in Munich how it reacted to the collapse of ancestral eastern markets by modernizing and shaping up its product line so that now its specialties are: custom-built high-tech equipment for simulation of characteristics of the environment, complete transportable climatic test laboratories, and outdoor measuring stations.

Germany: IBM-Siemens Collaboration to Produce 64 Mbit Chip

94WS0121B Berlin INGENIEUR DIGEST: WIRTSCHAFT & UNTERNEHMEN in German Nov 93 pp 29-31

[Article by Ulrike Scholz]

[Text] SUCCESS WITH INNOVATIONS

A message of top significance almost drowned in the general lamentation about the future of Germany's industrial status: At the end of September 1993 IBM and Siemens exhibited their first working samples of the first in the world 64 Mbit chip! Other German companies are exhibiting alongside Siemens: only by way of innovations in the "high-tech" technologies can the crisis be overcome with invigoration. Several items in the area of electronics manufacture which demonstrate this are displayed at the 9-13 Nov 1993 PRODUCTRONICA Exhibition in Munich, but is this enough?

Since 1990 have Siemens and IBM been working in expectation of this day. As to the public response to their success, managers and developers have indeed been more than disappointed. Hardly anyone seemed to take notice when at the end of September the first in the world 64 Mbit chip was shown. The newspaper BERLINER ZEITUNG found this event to be worthy of only three full lines in the WIRTSCHAFT (Economy) Section.

Some samples had already been previously distributed among select customers. The size of a single chip is 10.7x18.1 mm^2. The finest DRAM (Dynamic Random-Access Memory) structures, only 0.35 µm wide, had been produced by the photolithographic process in far-ultraviolet light.

Because of the most readily achievable symmetric and regular DRAM structure, production of this type of memory is so important to a semiconductor manufacturer that methods of producing ever finer such structures are being explored and developed for such memories. This type of memory is, in effect, the stimulator of technological innovations in microelectronics.

With this chip, a German enterprise has finally knocked the Japanese and the North Americans hard in the key

technology dominated by them. What the significance of this success will be in the long run remains to be seen. Meanwhile, a 256 Mbit chip is already being worked on by Siemens together with IBM and Toshiba.

This example indicates that there are some German enterprises which do not participate in general wailing about the recession but rather channel their strengths toward a leading position in the field of electronics. They are pursuing their chances particularly in specialty sectors of the market.

In electronics processing technology and production facilities, strongly emphasized at the PRODUCTRONICA, overseas competition is certainly still ahead. But even overseas innovations have helped German enterprises find a few niches. An example is the new LA 440 S sputtering apparatus, a joint development by the Von Ardenne Anlagentechnik (Equipment Engineering) Ltd in Dresden and the Balzers Hochvakuum (High Vacuum) Ltd in Wiesbaden. This apparatus facilitates deposition of thin films on wafers. It can be easily re-equipped to suit most diverse technological processes and sputtering methods, which is ideal for research and development. It demonstrates a high potential for electronics and machine manufacture in West and East Germany.

Another example is the Karl Kuess Ltd in Garching, worldwide leader in manufacture of x-ray stepper drives. They are used for x-ray lithography, a method of most highly integrated microchip structurization. This company has found a market in the U.S.A., since hardly any x-ray lithography is being done in Europe.

Recently Jenoptik is competing with its x-ray lithographic equipment against Karl Kuess in that overseas market. Its new X-Ray Scanner has attracted worldwide attention of professionals in this field.

Germany is also strong in communications engineering: Siemens, still the world master of innovations, has cropped a winner with its ATM (Asynchron Transfer Modus). This is a multiplexing and exchange system for the future broad-band telephone network. While synthesizing and standardizing this system, Siemens has simultaneously developed the now classical technology based on use of ASIC's (Amorphous-Silicon Integrated Circuits); just as it did for the GSM mobile radio system and for the cordless telephone in the DECT Standard.

New developments are budding even in East Germany, where the electronic industry sector quickly collapsed after having been previously subsidized while cut off from the international market. A scientific and technical potential is still to be found here: LSI Logik in Erfurt, VLSI Technologie in Dresden, Elektronikwerkstoffe (Electronic Materials) Ltd in Freiberg, Jenoptik in Jena, and many smaller candidates for niche positions in the market are vying for them.

In Soemmerda (Thuringia), where once the Robotron combine was manufacturing office machines, Germany's most modern computer factory is now in place and production has resumed beginning last October. In this new plant the ASI Computer Ltd will employ about 600 workers and produce at least 300,000 personal computers annually, which will make this enterprise Europe's largest PC producer. By manufacturing them in Germany, management hopes to respond faster to a fluctuating market demand and to thus extract pricing advantages better than is possible with imports from the Far East.

Take the Electronic Materials Ltd in Freiberg, the sole manufacturer of GaAs single crystals in Europe. After the West German previous manufacturer Wacker had closed shop, the Freiberg company was able to take over its European customers despite a few initial difficulties.

However, top-notch German electronic specialists are rather an exception: "There are no white elephants among the electronic companies" deplores Tom Sommerlatte. At the end of last October the Arthur D. Little consulting team had concluded its investigation of German companies. The objective was to identify those which had in the past three years, despite crisis and recession, realized above average output and profit gains. The list includes quite a few well managed medium-size industries, but no electronic companies.

By the way, Sommerlatte has nothing particularly good to say about the German economy anyhow. The enterprises, he claims, are far too frozen into their old business molds and originate very little innovation.

The Federal Republic is a land deficient in raw materials, which the Research Minister Paul Krueger is quite aware of. Therefore, it can retain its position as a leading industrial country only by top performance technologically and not being last in the field of electronics. Its only chance is investment in intelligence and creativity.

Jens Uwe Fuhrmann of the Bavarian VDMA [Verein fuer Deutschen Maschinenbau und Anlagenbau = German Machinery and Equipment Construction Society] agrees with the Research Minister on this point. But on the foreground of PRODUCTRONICA '93 he has also accused the intolerable power wrangle in Bonn of being responsible for the fact that future-oriented decisions made regarding Germany's research and industrial status are exceptions rather than the rule.

"Discussion about the status, though certainly needed, are missing the main point" believes Dr. Ekkehard Suess, chairman of the Productronic technical group within the VDMA. He demands more recognition for technical science, because it is the source of prosperity and jobs. "It is even helpful in protecting the environment" he said when addressing the PRODUCTRONICA '93 in Munich.

In the long run, Doctor Suess warns, "Germany will not be able to keep up with the international competition if chip production is left more or less to the Siemens company alone." For this key product line competition

in Japan, Korea, Taiwan, and now also in China is being backed by the "entire government machinery." Poor Germany!

Industrial manager Suess calls it outright pure nonsense that ensuring and promoting microelectronics production be entrusted to the Ministry of Research, already burdened by shortage of funds, instead of also involving the Ministry of Economy. As far as the Research Minister Paul Krueger is concerned, Ekkerhard Suess crashes open doors. The minister wants to focus his policy on "the new technologies which have good chances both economically and technically" so that the results of research can be faster converted into competitive products and processes. A top product line under consideration for the next ten years is electronics.

In order to push this through, Paul Krueger had formed a strategizing team which held its first meeting last September. Its task is to set in motion the needed dialog between scientists, economists, and politicians. Members of this team include Hubert Markl (former president of the German Research Society), Ernst-Ludwig Winnacker (director of the GenCenter), Heinrich von Pierer (on Siemens board of director), Edzard Reuter (on the Daimler-Benz board of directors), and Lothar Spaeth (business manager of Jenoptik). Krueger's model is Japan's innovation model. Eventually he will also bring about a general consensus in Germany.

The BMFT (Federal Ministry of Research and Technology) has just pushed through a project involving effective division of tasks between the Government and economic management, namely promotion of the Laser 2000 concept. As a part of this project there have been set up and are being tracked five sub-projects, with diverse objectives ranging from heavy-duty diode lasers to medical instruments.

France: Microsensors To Regulate Chlorine

94WS0116E Paris L'USINE NOUVELLE in French 4 Nov 93 p 65

[Article by Anne Lombard: "Chlorine Regulated At the Faucet"]

[Text] *The Lyonnaise des Eaux [water company of Lyon] and SAGEP [water company of Paris] are validating the first installation of electrochemical microsensors—amperometric cells costing less than 10 francs[Fr] each—to regulate the chlorine in potable water.*

Since chlorine must be used to purify potable water, sensors are needed to verify that the chlorine content is neither too high nor too low. The question is at one and the same time a legal one (0.1 mg/l of admissible residual chlorine), one of prevention (kill the bacteria without poisoning the drinker), and one of comfort (ugh! the horrible taste of javel water!). The answer? Regulate the dosage continuously and in real time. Drawn by the technology of chemical microsensors, Sagep, Lyonnaise des Eaux, and Parisienne des Eaux, have recently achieved the first chlorine amperometric microsensor for use in water. Apic Systeme, another subsidiary of the Lyonnaise company, together with Cylergie, a GIE [economic interest group] subsidiary of the Lyonnaise des Eaux, and the Swiss Microsens company, developed the measurement operating software. The project required three engineer-years and an investment of Fr1 million a year over a period of two years. Several pilot installations, each equipped with some 15 sensors, are undergoing validation in Paris and in the regions.

Enhanced Reliability

Manufactured as an electronics component, hence mass-produced, each amperometric cell will cost around 10 francs. At this price, it will be feasible to multiply the number of cells and to effect measurements on a continuous scale, in real time (the response time of the sensor is less than a minute), and with reliability enhanced by multiplying the number of measurement points. By means of these tiny throw-away chips (they are 1.5 mm thick, 4 mm wide, and have a life of six months), the chlorine will be regulated... at the consumer's faucet! By way of comparison, the macrosensors used, one at the output of a water treatment plant, and one at the input to the distribution network, cost Fr60,000 each. They require bimonthly maintenance. The microsensor requires none. The Lyonnaise company will market the method both by sale of the cell to other water companies, and in the form of a "pen" for spot-testing samples. The company is conducting research in the direction of bacteriological detection.

France: Metal-Base Printed Circuit Developed

94WS0172D Paris L'USINE NOUVELLE in French 2 Dec 93 p 68

[Article by Thierry Lucas: "From the Cire group: Printed Circuits that Diffuse Heat"—first paragraph is L'USINE NOUVELLE introduction]

[Text] A new metal-base substrate quite suitable for power electronics is currently being tested at Peugeot. It could also be used in telecommunications. Multiplexing considerably simplifies the electric wiring of vehicles, but it requires the development of very specific technologies. In particular, the printed circuit—the substrate of electronic component interconnections—must possess three qualities: good dissipation of the heat produced by power components, small overall dimensions, and both at an affordable price. The SMI (insulated metallic substrate) developed jointly with Peugeot by BREE (a subsidiary of the Cire group) meets these criteria. A preseries designed for use on 1,000 XM vehicles is being manufactured; it will be used to test the new process on a quasi-industrial scale.

The most original feature of SMI printed circuits is that they use a metallic base instead of the standard glass-epoxy material. Actually, the circuit is built on an aluminum foil no more than 3 mm thick, which is

covered with an insulating layer on which the copper conducting plate is pressed. Additional conducting layers can be obtained by using silver or copper-based polymer pastes. When the circuit is equipped with its components and mounted in the car, therefore, the heat it produces can diffuse into the metallic substrate and from there into the car body. This is an efficient solution that does not require adding a heat sink on the circuit—the usual method to improve heat dissipation in power circuits. According to Pascal Poisson, the BREE manager, the savings achieved by not having to purchase and install these heat sinks should offset the additional cost of the metallic substrate, so that the cost of the product would be about the same as that of a traditional circuit.

Industrializing the SMI process required the development of adequate production means. In particular, since aluminum foil is a malleable material it cannot be machined with the equipment traditionally used in making printed circuits. The metallic plates must therefore be drilled, cut, and scribed with special tools developed by BREE.

The conveying and loading/unloading systems were also modified to accommodate the new substrate, which is heavier than traditional substrates.

A total of 1 million francs was invested in preseries production facilities. The Peugeot group's certification of the insulated metallic substrate already created considerable interest from other potential clients (in telecommunications). They are waiting for the first results of the full-scale test performed on the 1,000 XM vehicles which, according to BREE, might warrant going on to mass production.

Expanding European Market for Chip Cards Seen

94WS0139A Duesseldorf WIRTSCHAFTSWOCHE in German 3 Dec 93 pp 96-99

[Article by Burkhard Bondel: "New Pillar"]

[Text]

Electronics

Europe's Semiconductor Industry is Finally Holding a Trump Card: The Chip Card.

"I'm going to buy some bread," calls the five-year-old to his mother on Saturday morning. She replies, "OK, but don't forget the chip card." Benjamin routinely pays the baker with the card.

"Where did you last see a doctor?" asks the physician in Munich. He is talking to the tourist from Hamburg who is having heart trouble. Instead of answering, the patient inserts the medical insurance record chip card into the physician's computer, releases the data stored in the chip using his personal identification number, and allows the doctor to read the patient's history.

"Please insert your chip card," requests the screen of the new arrival. Only after comparing the typed code with the code stored on the chip card does the computer network become enabled for the user.

Paying, storing, unlocking. The variety of applications of the plastic card is virtually inexhaustible thanks to the integrated chip that may contain a complete minicomputer. The handy medium is opening completely new possibilities of drumming up customers primarily for the service branch. "The present applications are just scratching the surface," says Hans-Dietrich Kreft. He is the managing director of Angewandte Digital Elektronik (ADE) from Dassendorf in North Germany. Kreft is one of the most committed trail blazers of the chip-card technology. The untiring promoter was among the winners in 1987 of the innovation prize of the German economy. Today, he can be certain that the chip card is conquering the world with mass applications.

The Europeans, in particular the French and Germans, are the front runners. They have an important advantage, "the larger domestic market," says Winfried Gaal. He is the product manager at Giesecke & Devrient (G&D), a chip-card manufacturer in Munich.

After successfully introducing the phonecard, the Germans are now reaching for the chip twice with the medical-insurance chip card and a new Euroscheck [check guarantee] chip card. While the electronic substitute for the medical insurance record card will be introduced starting on the first of January 1994, the new 'ec' chip card will presumably be available in 1995, according to information from the banking branch. About 120 million chip cards will be necessary just for these two applications.

The European electronics industry, which has not exactly been spoiled, is the beneficiary. "The chip card can become a new pillar for the European semiconductor industry," predicts Ulrich Hamann. He is the director of marketing for chip-card ICs at Siemens AG.

Besides Motorola as the only non-European, just Siemens, Bull, SGS-Thomson and Philips possess the necessary know-how and fabrication capacities at this time. Due to this, the ranking of vendors is unusual for electronics conditions. With 30 per cent of the market, both Siemens and Motorola are running neck and neck, followed by SGS-Thomson and Philips. Hitachi appears in fifth place as the first Japanese chip manufacturer. It has a skimpy six per cent of the market. The Europeans have fallen by the wayside in the triad competition. However, they may be able to experience another success story with the chip card similar to that for the GSM standard for cellular telephones. This has proven to be an export hit.

In any case, the timing of the market introduction is perfect. The insurance card does not appear to make sense at first glance because the potential of the chip is not fully exploited. Only the data present on the medical insurance record card are stored. The physician prints

out a standardized form with these data and continues to handwrite his services on this form. However, this is just what the semiconductor manufacturers want. On the one hand, "Using these relatively simple chips, we can learn how to stabilize our production process," according to the Siemens expert Hamann. On the other hand, the corresponding readers and physician's computers will create an infrastructure that will subsequently enable the use of more demanding chip cards.

Consequently, the big bang in the card industry is set. Market surveys by Siemens claim that the world market for the chips the size of a finger nail will grow from 160 million marks last year to almost 1,000 million marks in 1997. Of this amount, the German chip manufacturer wants half. Axel Hartstang is the managing director of the German subsidiary of Motorola. He expects that sales of less than 50 million cards currently will grow almost ten times to more than 400 million within five years.

In this respect, the chips are only a fraction of the business. They must be integrated into the card and personalized for the individual user by special service providers. For image reasons, marketing strategies allow the plastic substrate to accept high-quality printing. In addition, the system operates only with readers.

With the domestic market and technical lead, the Europeans have the best chance of dominating the world market over the long term. Card producers such as G&D, Orga Kartensysteme, Oldenburg, Gemplus and Schlumberger are already supplying their products to the burgeoning markets in Australia, Brazil, South Africa and Hong Kong. Success is beckoning Siemens even into the lion's den. The conglomerate from Munich is on the verge of completing deals with Dai Nippon Printing and Toppan, two of the largest printing firms in the world. The company from Munich is to supply chips to Japan. The chips will be installed in cards there.

The Europeans have also been working flat out on chips that offer processors and complex operating systems (so-called controllers). Courageously, they are now defying Motorola, the vendor previously dominant in this sector. These open systems form the prerequisite for so-called multifunctional cards. Such cards allow not only one special application but can even be equipped with new functions later.

Consequently, according to the plans of the Central Credit Committee (ZKA), the owners of the new 'ec' cards will not just be able to withdraw cash from automatic teller machines and make telephone calls. These cards will also function as electronic wallets. To allow for the transfer of small amount such as paying for bread, the chips are loaded with specific sums which can be paid out little by little. For larger amounts, a credit line is stored on the card. Even the primitive medical insurance chip card will be extended to a comprehensive patient card over the long term. Then, it will store data regarding accidents and portions of the medical history in addition to management specifications.

Such multifunctional cards could also work as tickets for buses and trains. While buying the correct ticket at an automat is more of a game of chance today—primarily in strange cities—the electronics does everything for the user of the chip card. "Because of this, we are hoping to reduce the inhibition threshold and get more customers to use public transportation," says Achim Muller. He is the managing director and consultant for the cities of Luneburg and Oldenburg.

Without having to study any sort of schedule, the rider inserts his card into a reader when entering and exiting. The central computer can then not only determine the cheapest fare. Frequent riders also get a discount. In Luneburg, no rider pays more within 30 days than the price of a monthly ticket.

IBM-Siemens-Toshiba Cooperation to Develop 256-Megabit DRAM Chip

94WS0171C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 29 Dec 93 p 8

[Article by TAR: "DRAM Chip With Trench Cells"]

[Text] Frankfurt—IBM, Siemens, and Toshiba want to use a trench-cell structure in developing their common 256-megabit DRAM memory chip. This structure was recently presented on the occasion of the International Electron Devices meeting of experts in this field in Washington. What is involved is a self-aligned trench-circuit contact which is defined by the intersection of a deep trench-memory node and the "shallow" trench insulation. As described in the journal SEMICONDUCTOR INTERNATIONAL (Vol. 16, 1993, No. 12, p 18), the trench cell, a "buried" strip, is 0.55 x 1.1 micrometers in size. It is produced with the aid of the 0.25-micrometer technique. The cell surface is claimed to be only 0.1 of a square micrometer larger than the theoretical minimal surface of such a cell and the smallest of the folded bit-circuit cells that have been proposed. It differs considerably from Mitsubishi's planar-stacked capacitor-cell design, which was also reported on at the Washington conference. The superdielectric, constant barium-strontium-titanate film was also discussed.

NUCLEAR R&D

CERN Director Proposes Thorium-Based Reactor

94WS0153D Paris AFP SCIENCES in French 25 Nov 93 p 16

[Article: "Revolutionary Nuclear Reactor Proposed by CERN Director"]

[Text] Geneva—Nuclear generating plants powered by an inexhaustible energy source that is also virtually

risk-free and poses no military proliferation threat: This is the revolutionary project unveiled on 24 November in Geneva to some 500 physicists from all over the world by Professor Carlo Rubbia, director of the European Particle Physics Laboratory (CERN).

Speaking in CERN's crowded amphitheater, the Nobel Prize-winning physicist explained that ecological concerns had motivated his conception of this project, which builds on earlier work and consists essentially of an "energy amplifier" driven by a heat-producing particle accelerator. In other words, the project consists of "extracting energy from heavy nuclei with the help of nuclear cascades induced by an accelerator." One might even go so far as to envision an "upsurge in global demand for nuclear energy to replace fossil fuels" such as hydrocarbons that engender so-called "greenhouse gases" and contribute to warming of the earth's atmosphere.

According to Mr. Rubbia, the particle amplifier, which would use thorium (abundantly available) rather than uranium as fuel, represents a safer solution because the reactor would be "subcritical" and there would be no danger of chain reaction.

Mr. Rubbia noted the general public's misgivings about traditional nuclear reactors in light of accidents such as Three Mile Island and Chernobyl and the need to bury highly radioactive waste products for very long periods of time. Use of thorium in this way would offer the advantages of "being simple, safe, cleaner, not posing any important technological hurdles, nonproliferating, and inexhaustible," Professor Rubbia said. Small plants would produce virtually no plutonium, and "no one could make a bomb with it." But Professor Rubbia concluded on a warning note: The project is still at the stage of "virtual reality, and experimental verification will be required," along with very complex calculations, before the idea is implemented.

According to CERN spokesman Neil Calder, Mr. Rubbia has computer-tested his theory and plans to begin experimental work on it next year at CERN. Most of the physicists reacted positively to the proposal, Mr. Calder said.

In his presentation, the Nobel Prize-winner said his work was based on research done in the 1950s by W. Lewis (Canada) and more recently by Professor C. Bowman's team at Los Alamos (New Mexico). At the end of December, Mr. Rubbia will step down as director of CERN, which he has headed for the last 5 years, and will be replaced by Christopher Llewellyn Smith. He will then devote himself entirely to his energy project.

CERN Considers Final Hadron Collider Proposal

94WS0174D Paris AFP SCIENCES in French 23 Dec 93 p 11

[Unattributed article: "LHC [Large Hadron Collider] Project Presented to CERN Council"]

[Text] Geneva—On 17 December, the board of the CERN [Nuclear Studies and Research Center] (the European Particle Physics Laboratory), which includes representatives of its 19 member states, reviewed the final version (technical parameters and budget) of the LHC (Large Hadron Collider) project which, if built, will be the most powerful particle physics facility in the world.

According to Professor Christopher Llewellyn Smith (Great-Britain), who will succeed Professor Carlo Rubbia as CERN director on 1 January 1994, the cost of this giant proton-proton collider, which will be 10 times more powerful than the CERN's present electron-positron ring, the LEP (Large Electron-Positron Collider), is estimated at 2.23 billion Swiss francs (nearly 9 billion French francs [Fr]).

If it is approved by the board during the first half of 1994 (the decision should be made in April), construction of the LHC might start in 1995 and be completed in 2002. The expenditures concerning the project were included in the CERN 10-year plan for 1995-2005. Pr. Llewellyn Smith said that member states might increase their participation and mentioned the possibility of both intellectual and financial contributions from nonmembers, such as the United States now that the SSC [Superconducting Super-Collider] project has been abandoned, which "complicates the decision."

In fact, a few weeks ago, the U.S. Congress refused to go on with the construction of the SSC—a project similar to the LHC but still more gigantic and powerful—which was deemed too costly (total cost: about $11 billion). People in Geneva estimate that, as a result, "thousands of physicists, in particular U.S. physicists, will be tempted to come and work at the CERN" if the LHC is built.

France is in favor of building the collider, which will be set up above the LEP, in the 27-km-diameter ring under the French-Swiss border. Early in November, Russia expressed its intention to contribute to the construction. In addition, Switzerland recently announced that it would grant the CERN a loan of 34.4 million Swiss francs ($23 million) for the construction of a new building that might provide an additional 876 work stations.

Every year, 6,000 scientists from all over the world (including already an increasing number of Americans) come to the CERN, which has a permanent staff of 3,000. For over 10 years now, the CERN has been the leading particle physics laboratory in the world. Building the LHC would enable it to retain its rank and to make new discoveries, several of which have already been predicted by theoreticians, for instance that of Higgs' boson.

The CERN board also approved the laboratory's 1994 budget, which amounts to 924.1 million Swiss francs, compared with 951.67 million Swiss francs in 1993.

Karlsruhe Nuclear Center Opens New Tritium Laboratory

94WS0143B Duesseldorf HANDELSBLATT in German 2 Dec 93 p 14

[Article by "nl" under the rubric "Research and Technology": "Karlsruhe Tritium Laboratory/Laboratory Studying the Fuel for an Energy Source for the Distant Future/Settling of Safety Problems. Fusion Research Has Supplanted the Fast Breeder"; first paragraph is an introduction]

[Text] Duesseldorf, Wednesday, 1 Dec 93 (HANDELSBLATT)—Now a tritium laboratory (TLK) has officially opened at the Karlsruhe Nuclear Research Center. This is an experimentation facility by means of which nuclear researchers want to acquire precise information and working know-how in dealing with larger quantities of tritium—a necessary step toward the hoped-for commercial exploitation of nuclear fusion for the generation of electricity in the still distant future.

The acquisition of reliability and safety data have to have high priority here. Tritium, the heaviest of the three isotopes of hydrogen, along with deuterium (heavy hydrogen) is needed as fuel for plasma fusion reactors. Nuclear fusion—the fusion of light atomic nuclei and the atomic-energy-liberation process of the sun—is at some time to be utilized in fusion reactors on the earth for energy transformation and the generation of electricity. Therefore, TLK's specified tasks are dictated by the requirements of research and development work on fusion research. The nuclear research center is included with the fusion project in the European fusion technology program and in the ITER (International Thermonuclear Experimental Reactor) reactor project.

With TLK the nuclear researchers in Karlsruhe have the first finished experimentation facility of this size for fusion research in Europe. As yet they have seen comparable facilities only in Los Alamos, USA and Tokaimura, Japan. The laboratory was built over a period of seven years with an investment of around 45 million German marks [DM]. The state of Baden-Württemberg and the Federal Ministry for Research and Technology each absorbed in a special financing arrangement 50 percent of the costs incurred. The Nukem and Siemens companies were appointed as general engineers by the nuclear research center for construction of the laboratory.

The laboratory was built in the same building in which a breeder test stand was built in the seventies. This demonstrates the change in KfK's [Karlsruhe Nuclear Research Center's] scientific-technical problem range and the reconstruction of its infrastructure and experimentation facilities. Working with the lightest elements, the isotopes of hydrogen, is being practiced today in the same room in which years ago heavy elements like uranium and plutonium were dealt with.

Radioactive tritium has a (relatively short) half-life of 12.3 years, but at the same time high diffusibility through other materials. The researchers want to achieve the safe handling of this hydrogen gas by means of a multiple barrier system. This consists of the metal walls of the equipment and pipes in which the gas is handled. In addition, all the apparatus is enclosed by a secondary system with glove boxes, a sub-atmospheric-pressure maintenance system, and tritium hold-up.

Development Work for Protection of Personnel and the Environment

The building itself constitutes the third barrier. Its exhaust air is constantly monitored. Not only will the feasibility in principle of the occurrence on just the earth of the fusion process that takes place in the sun be decided one day by the realization of this process in a reactor, but also the solution of as yet less discussed safety problems in the protection of personnel and the environment.

As a priority, chemical and process engineering problems relating to cleaning the fusion reactor fuel mixture will be worked on within TLK's range of tasks—like, for example, the removal of impurities such as oxygen and nitrogen. Uranium, which combines tritium in the form of uranium tritide (a stable uranium-hydrogen compound) acts as a storage medium. The tritium can be set free again by heating up this storage medium, and the tritium is then available for experiments. An integrated isotope separation system can separate the components of hydrogen mixtures into normal hydrogen (H), deuterium (D) and tritium (T) and resupply the thus purified tritium to the experiments. The pilot plant's process control system is automated and permits round-the-clock operation.

Germany: Encapsulated Ge-Detector Developed for Euroball Project

94WS0156B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 10 Dec 93 p 8

[Article by SEL: "Encapsulated Ge-Detector"]

[Text] Aachen/Juelich—An encapsulated Ge-detector has been developed by the Juelich research center (KFA [Nuclear Research Facility]) in collaboration with the University of Cologne's Institute for Nuclear Physics and the Intertechnique company in Strasbourg. The ultrahigh-vacuumtight, encapsulated germanium detector was brought to production readiness in the main Department of Technology within the framework of the Euroball project. The so-called Euroball is a gamma spectrometer that is being developed through European cooperation and will be used for experiments in the field of high-precision gamma spectroscopy. With it exotic nuclei of borderline stability can be studied.

In addition to greater reliability, the advantages of the Ge-detector are protection of the extremely sensitive surface of the detector as well as ease of operation and interchangeability. Furthermore, it is possible to join

Ge-detectors together into complex detector arrangements of any kind whatsoever. These detectors can be regenerated without any problems when there is radiation damage by heating them up in standard ovens.

The range of applications of Ge-detectors includes gamma spectroscopy for the identification of exotic atomic nuclei, applied research, protection against radiation and of the environment, and applications in the field of medicine. Furthermore, the Ge-detectors presented by the KFA nuclear physics institute in Juelich in the journal "Inside KFA" (No. 3) can be used in industrial production control and space.

In connection with technology transfer, the Juelich research center has concluded a licensing agreement for the production of encapsulated Ge-detectors with Intertechnique. A patent for the production process has been applied for at the German Patent Office. This year a total of 16 detectors were produced and delivered.

France: Experimental Nuclear Accident Attempted

94WS0167A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 6 Dec 93 p 10

[Article: "Nuclear Accident as Experiment"]

[Text] Marseilles/Paris (DPA/AP)—At the nuclear research center in Cadarache near Marseilles they are trying to deliberately bring about a meltdown of the sort that occurs during a presumed major accident in a power plant. The researchers hope to gain clues from this experiment as to how to improve the safety standards for future nuclear reactors. The experimental plant in Cadarache was provided with additional safety equipment to prevent radioactivity from escaping from it. Moreover, the experimental reactor contained only a small fraction of the amount of fuel in reactors of the customary size. That is why critics of the experiment have doubts as to whether the results obtained here in the laboratory can be applied to the conditions in large nuclear power plants. There were contradictory statements with regard to the duration of the experiment, which might also indicate that the experiment could have been prematurely terminated on Thursday of last week. It further means that the results of the experiment will be reported on in the course of this week. The institute wants to undertake five more experiments of this kind over the next few years.

Germany: Subsidies for Innovation, Research Called For

94WS0167B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 16 Dec 93 p 8

[Article by TN: "Subsidies for Innovations and Research Personnel; Federal Aid for Research for New Federal States: A Ministry of Economy Survey"]

[Text] Frankfurt—The federal government's economic aid measures in the new federal states are extensive. These aid measures are described on 230 pages in the minister of economy's new brochure (BMWi [Ministry of Economy]: "Economic Aid in the New Federal States," 53107 Bonn, Public Relations Department). The currently relevant aid measures for research in the new federal states should be represented below. Applications and detailed information may be requested from the addresses given. At the present time the most important measures are being supported by the Ministry of Economy and the Ministry for Research and Technology (BMFT). They can be summarized as follows:

1. Aid for innovations: Aid is provided for projects for the development of innovative products by legally independent firms with less than 1,000 employees of the industry that produces them in the new federal states. The conditions are: 35 to 40 percent of the costs of the development project per firm, with a maximum of DM800,000. Address requests for advice on applying for aid to: Aid for Innovations, Establishment of Technology-Oriented Companies, VDI [Association of German Engineers]/VDE [Association of German Electrical Engineers] Technology Center for Information Technology, Budapester Strasse 40, 10787 Berlin. Telephone: 030/264890; fax: 030/26489141.

2. Research staff in small companies (BMWi): a maximum of DM240,000 a year per company with its head office in the new federal states and less than 1,000 employees. Applications and information available from AIF (Working Association of Industrial Research Associations), Berlin. For existing increases in research personnel, commissioned research, and cooperation on research: AIF, Berlin Branch Office, Tschaikowskistrasse 49, 13156 Berlin. Telephone: 030/4826649; fax: 030/4824366.

3. Aid for increases in research personnel (BMFT): Firms with up to 1,000 employees may receive up to DM250,000 a year for an increase in research staff. Applications through AIF, Berlin.

4. Industrial association research: It is only supported for AIF member associations.

5. Commissioned research in two forms for companies in the new federal states. Applications through AIF, Berlin: Contributions of 50 percent, but not more than DM300,000 per company with less than 1,000 employees and with its head office in the new federal states and commissioned research farmed out.

   Contributions to contractors of commissioned research in the new federal states in the amount of 40 percent of the total costs thatqualify for contributions, provided that these institutes or companies have less than 250 employees.

6. Aid for the establishment of technology-oriented companies: Individuals who want to found a technology-oriented industrial enterprise and companies that have been operating in this field for no more than two years may receive up to DM1.8 million. Applications through VDI/VDE, Berlin.

7. Loans for research: Research loans are granted throughout Germany and can be applied for through the local bank. Companies with a sales volume of up to DM50 million can obtain a total loan of up to DM3 million at a current interest rate of 5.75 percent a year and a term of 10 years. The loan is paid off through the Credit Bank for Redevelopment, which manages BMFT funds for this purpose. For research loans: the local bank, which rediscounts the loan through the Credit Bank for Redevelopment.

8. Furthermore, until 1997 there will still be a research bonus (a specific indirect subsidy) amounting to DM600,000 per company throughout Germany for the application of biotechnological methods. Applications and information: Juelich Nuclear Research Center, Biology Project Sponsor, P.O. Box 1913, 52425 Juelich, telephone: 02461/613171. For research bonuses in biotechnology: Juelich Nuclear Research Center; Biology, Energy, and Ecology (BEO) Project Sponsor, telephone: 02461/613171.

9. Joint research in the economic sector: The BMFT grants up to DM600,000 per company for joint research between at least two companies in Germany that have no more than 500 employees. Applications and information available from AIF.

Germany: Juelich Reactor Uses Cross-Flow Technique in Simulation

94WS0167D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Dec 93 p 8

[Article by JB: "Juelich Reactor Operates With Biomass Support; Activated Sludge Tank Simulated; Separately Ordered Filtration Uses Cross-Flow Technique"]

[Text] Juelich—Bacteria perform important tasks in sewage plant activated sludge tanks. They break down a multitude of undesirable compounds like ammonium and highly ecologically harmful, problem-creating substances. Simulation of the growth processes in these tanks is necessary in order to study the decomposition processes. Wolfgang Tappe of Juelich Research Center, Ltd., (Institute for Biotechnology [IBT3], 52425 Juelich) has now developed a bioreactor system that is suitable for these tasks.

As Tappe informed us in Juelich, bacteria grow in the soil and in water, as well as at sewage plants, at very low rates of growth. The supply of nutrients is frequently so limited that it is only enough for bacteria to survive, but not sufficient for growth. The study of these processes is important in view of the services bacteria render in breaking down harmful substances. With conventional bioreactor systems, however, simulation of these kinds of growth conditions is impossible or only very limited. With a continously operating laboratory bioreactor, a specific amount of fresh nutrient solution per time unit is supplied and the corresponding amount of consumed medium removed. In the process, biomass is also lost, which has to be replaced by the growth of the bacteria in the reactor. Now if the organisms' maximal rate of growth is very low, the danger exists that the lost biomass can no longer be replaced.

Since the average generation periods at activated sludge plants range from 150 to 500 hours, they are comparatively long. In simulating these growth conditions, conventional bioreactor systems are frequently overtaxed. Since the nutrient supply in this case is only very little, an even distribution is in part no longer attained in the reactor. The result is that the bacteria population is no longer homogeneous. Some bacteria grow faster than others.

The solution to the problem lies in the Juelich reactor with biomass support. The principal difference between it and the conventional, continuously operating reactor is a separately ordered filtration module. In it the consumed medium is filtered out while the bacteria are held back. The filtraiton process is not simple since the round filter has a tendency to get blocked. Tappe has solved this problem with the cross-flow technique. A magnetic agitator that creates a flow that moves at right angles to the direction of filtration (cross-flow) rotates right above the membrane. With this system, blockages can be successfully prevented.

The molecule is surrounded by a high-grade steel housing and is connected with the reactor container by hoses and pumps. In this way a continous supply of nutrients can be obtained without any loss of biomass and bacteria with very low rates of growth can be studied. These growth conditions come very close to the actual conditions in activated sludge tanks. The Juelich system's filtration module can also be used for on-line monitoring of sewage plants. It delivers a biomass-free sample from which chemical parameters can be determined.

European Nuclear Waste Storage-Related Issues Analyzed

Paris LE MONDE in French 12 Jan 94 p 12

[Article by Jean-Francois Augereau: "Nuclear Waste: Worldwide Problem"]

[Excerpts] Installation of Storage sites Is Posing Problems Everywhere in the World

Where should waste from nuclear projects be stored? How can it be done under conditions acceptable to all? The issue is so sensitive and the public is now so watchful and cautious that the governments of nuclear energy producing countries think twice before presenting their proposals. Ten years ago, who would have predicted the proliferation of mediators, sent to the front

lines by public administrations, nuclear industry manufacturers, and brand-new agencies in charge of managing this waste, to inform, reassure, answer questions, and consider everyone's probing and apprehension before reaching any decisions?

Nuclear power can no longer be forcefully imposed; public administrations have understood this and have learned their lessons from the past. In February 1990 the Rocard government, aware of difficulties it would encounter if it imposed this or that site for storage of highly active waste from the nuclear industry, chose to halt hostilities with the determined population on 9 February 1990 and to let time do its work. Of course this decision was not completely devoid of electoral considerations, but excessive coercion eventually creates a trap which Rocard wanted to avoid by declaring a one year moratorium on the management of these awkward waste products.

The 30 December 1991 law on this issue has formed a legislative framework for any new steps in this regard and given mediator Christian Bataille the heavy responsibility of consulting constituencies and collecting voluntary proposals from communities interested in the installation of an underground laboratory for research on nuclear waste. This was a good initiative and about 30 such proposals came quickly to light.

Today, four departments, Gard, Haute-Marne, Neuse, and Vienne have been tentatively selected by Bataille (see LE MONDE of 6 January) and the government has just authorized the Radioactive Waste Management Agency (ANDRA) to begin geophysical surveys of the sites. Here again, cautiously, the authorities will take their time for one to two years before reaching any decision.

Groundbreaking for the laboratories, which will cost 1.5 billion francs each, cannot begin before the end of 1997 at the earliest, which means that operations would begin in 2002. This would be followed by eight years of research on site quality (nature of bedrock, water flow study, deeply-imbedded materials performance, and so on); this is because ANDRA is not scheduling materials storage before 2020 at sites that have yet to be determined assuming the program is authorized to continue after Parliament deliberations around 2010.

This surfeit of caution is not unique to the French authorities: all nuclear energy producing countries are facing the same type of problems. As a matter of fact, France is managing fairly well at present with its surface storage for low radioactivity waste at the Hague (Manche) which is filled, and at Soulaines (Aube) which has just opened. The only remaining problem is to, so to speak, settle the delicate issue of permanent storage of highly active waste. One step has just been taken with Bataille's report. Many other countries wish that they were that far along.

Strong Local Opposition

In Europe the situation has more facets as a few examples will illustrate. In Germany where disagreement is sharp, it is clear that all nuclear industry waste will be stored underground regardless of its radioactive level. Storage has already been established at two locations for low and medium-activity radioactive waste: at the former salt mines in Morsleben near the old East German border, and at Asse (Lower Saxony). The latter has in fact been for some years, the site of international experiments for storage of high radioactivity waste.

Two other sites also in Lower Saxony are currently being discussed as possible storage centers. The first is in Gorleben where two wells are being drilled in a salt dome for high radioactivity waste, the first shipments of which may come in 1994 and 1999 from France and Great-Britain. But work on this project has been stopped. The second is at the Konrad iron mine for less radioactive material. But its placement into service is being hotly contested between the federal government and the Lower Saxony authorities.

In Switzerland where there a research laboratory in granite already exists at Grimsel, nuclear industry waste is housed on-site at plants and research facilities, while waste resulting from other industry activity has been temporarily stored since 25 November 1992 at a 9.3 million Swiss franc installation in Wurenlingen in the Argovie canton. For permanent storage, the Cooperative for Radioactive Waste Storage (CEDRA) approved in June of last year a center whose cost is estimated at 500 million francs and which would be built in Wellenberg in the semi-canton of Nidwald.

Swedish Example

But canton authorities are blocking current construction based on their recently acquired legal power to grant licenses for underground utilization. Many discussions must yet take place before Parliament issues a decision (in 1997?) on this proposed center whose operation could begin in 2005. As for high radioactivity waste, this is only the beginning.

Preliminary drilling intended to analyze the nature of the soil (granite and gneiss) has already been conducted in the northern part of the country in Bottstein, Leuggern, Weiach, Kaisten, Schaffisheim and Siblingen. Other drilling operations have been requested by federal authorities to prospect clay deposits in the Aar Valley and in the area between Baden and Schaffhouse. But as the JOURNAL DE GENEVE pointed out last summer, in Siblingen, the canton authorization procedure for drilling took six years while at the federal level it took one year and eight months. "All that time to come to the realization that the site was not suitable..."

Clearly waste management is not an easy matter and according to nuclear energy promoters it is hampered less by technical difficulties than by social and political problems. The country currently having the most success

in resolving them is Sweden, whose early decision against reprocessing irradiated fuels at its plants has made the choices easier.

Sweden has an underground facility, the SFR, carved out of granite on the Baltic coast not far from the Forstmark plant, which since April 1988 has been used for permanent storage of low and medium radioactivity waste. At the same time the Stockholm government in the early 1980's commissioned an enormous underground storage center in Oskarshamm, the CLAB, intended for storing irradiated fuels from Swedish plants for 40 years before they are permanently buried in the substrata of the country's two northern communes situated right in Lapland near Arjeplog and Overkalix (see LE MONDE 17 September 1992).

Discussions are underway to determine which of these two locations may receive these vexatious ashes. There is no hurry, even if it takes time to win over a very skeptical public opinion. This is why, in spite of CLAB's intermediate storage (CLAB received its first highly radioactive shipments in July 1985), the Swedes want proof "through a dress rehearsal" that their permanent storage plan in granite is efficient.

The Swedish Fuel and Radioactive Waste Processing Company (SKB) has thus begun drilling a deep tunnel in granite at Orskarshamm near CLAB; this is the Aspo Hard Rock Laboratory (HRL) which is intended to serve as proving grounds for the engineers. The whole facility should be completed at the end of 1994 or the beginning of 1995. But unlike its Canadian counterpart, URL at Pinawa in Manitoba, this underground laboratory will not be converted to a storage site.

SUPERCONDUCTIVITY

UK: Impurity Doping Makes HT Superconductors More Stable

94WS0148A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 1 Dec 93 p 8

[Article by oel: "Impurity Doping Is To Make HT Superconductors Capable of Carrying More Load"]

[Text] Frankfurt—Application of the new high temperature superconductors (HTSL) still fails in many areas because the superconductivity is lost under the influence of comparatively weak magnetic fields. When ceramic materials under the influence of magnetic fields get a little below a Tesla, they are only superconducting at very low temperatures of a few Kelvin. For important practical applications superconductivity under magnetic fields can therefore only be used with metallic superconductors and by cooling with expensive liquid helium.

But physicists of the University of Birmingham (School of Physics, Birmingham B15 2TT, United Kingdom) have now succeeded in making the movement of the magnetic field lines in high temperature superconductors visible. Consequently, there is now an opportunity directly to observe the effect of measures against the drifting of the field lines.

With this discovery the developers of high-temperature superconductors hope to be able to solve the problem in a way similar to the comparable behavior for metallic superconductors: By doping the material, the field lines are "frozen," which makes the construction of high-performance magnets for computer tomography possible, for example.

The observation and image recording of the magnetic field lines in high temperature superconducting materials succeeded with a neutron-scattering method in a bismuth, strontium, calcium-copper oxide high-temperature superconductor. The methods used so far in order to determine the collapse of the magnetic field lines were based on indirect measurement processes which did not give an image.

With the neutron scattering method both the crystalline structure and the field line can be recorded. If the high-temperature superconductors being studied are under the influence of a magnetic field and the temperature is raised from a few degrees Kelvin, after a certain point there will be such large internal resistances that this causes the crystalline structure to be lost.

This has the result that the superconducting state is also abruptly halted. Because of this phenomenon the British physicists speak of a "melting away" of the magnetic flux structure (flux lattice melting). In the high temperature superconductors available today this will already take place at temperatures between four and ten Kelvin.

The continued development work by several research groups in Europe, the United States and Japan is now aimed at finding ways to prevent the "migration" of the magnetic field lines as far as the area of critical temperatures between 90 and 100 Kelvin. With the "old" metallic superconductors this could only be achieved by adding certain compounds. Nevertheless, it took almost 10 years before this doping technique had been mastered from the aspect of production technology. Whether this will be achieved for high-temperature superconductors in a similarly long development process, is something no one dares predict.

Meanwhile, the development work continues in the United States as well. With massive support from the U.S. Department of Energy, the development of efficient current limiters for public grids from high-temperature superconducting materials is to be accelerated.

As reported by the authority, a consortium of three enterprises and a government research laboratory headed by the General Dynamics company (San Diego, California 92186, USA) has been awarded almost 5 million dollars for these development studies.

These funds are to help the company develop operational current limiters in two to at most four years. The authority expects that by using the new type of current limiters energy losses on the order of 100 million dollars a year can be avoided.

Current limiters are relay-type switches which keep the currents in high-voltage grids within certain ranges. They reduce the network current if, for example, lightning strikes or if there are short circuits. They protect the power consumers against having their equipment damaged by excessively high current.

By installing superconducting current limiters in high-voltage networks, relatively simply constructed and cheap power interrupters and simple fuses can be used. The investment and operating costs of the supplying enterprises could thus be reduced and the production of excess power be avoided.

This way the output of the supply networks can take place in certain voltage ranges, which leads to considerable savings for the power supply companies even at relatively modest cost.

The new high temperature superconductors which are being used for this are not under the influence of magnetic fields at the limiter circuits. For that reason, even with the critical currents of high temperature superconductors reached today they can be used without any further difficulties.

Superconducting switching elements have the advantage over conventional current limiters that they regulate the supply currents with very short switching times, practically unnoticed by the consumer, and in this manner provide largely uniform currents.

France: High-Temperature Superconductivity Record

94WS0174C Paris AFP SCIENCES in French 23 Dec 93 pp 9, 10

[Unattributed article: "High-Temperature Superconductors: Dramatic Breakthrough by Two French Teams"]

[Text] Paris—Within a few hours of each other, two teams headed by French scientists announced that they had achieved a dramatic breakthrough in the field of superconductivity, raising it for the first time to around zero degree Celsius, and thus heralding the day when superconductors will be available at room temperature and under normal pressure.

On 17 December, the CNRS [National Center for Scientific Research] announced that researchers at two of its Grenoble laboratories had obtained mercury cuprates that are partially superconductive at temperatures ranging from 190 Kelvin [K] (-63 degrees Celsius [C]) to 280 K (+7 degrees C), thus beating the 250 K (-23 degrees C) record announced less than 24 hours before by a team of the Higher School of Industrial Physics and Chemistry of the City of Paris (ESPCI) headed by Michel Lagues—which record, according to the researchers themselves, remains to be verified.

Although these results were obtained by different methods and with different compounds, nevertheless they prove the existence, long in doubt, of superconductivity at a very high "critical temperature" (below which a material will conduct electric current without opposing any resistance to it). Less than three months ago[1], the record was only 157 K, at a pressure of 235 kilobars (about 235,000 atmospheres), whereas the new results were achieved under normal pressure.

The Grenoble researchers, at the Research Center on Very Low Temperatures (Jean-Louis Tholence, Benedict Souletie, Olivier Laborde) and at the Crystallography Laboratory (Catherine Chaillout, Jean-Jacques Capponi, Massimo Marezio, and Miguel Alario Franco) obtained mercury cuprates, consisting of mercury, barium, calcium, and CuO_2 copper oxide, and more precisely with [sic] the phase Hg-1223 ($HgBa_2Ca_2Cu_3O_{8+d}$), as well as Hg-1245.

What did the team headed by Jean-Louis Tholence and formed nearly seven years ago observe? The two "signatures" of superconductivity: a sudden drop of electric resistance (in seven of the samples) and the "diamagnetic transition," which shows as an apparent magnetization in a direction opposed to that of the magnetic field applied to the sample (on the 15 or so samples), at temperatures ranging from 190 K to 280 K, depending on the compounds.

According to Jean-Louis Tholence, the record, a "superconductive transition" at 280 K, was observed on "one percent of the sample volume." Its structure remains to be determined in order to obtain samples with larger "superconductive" fractions. A report on this research will be published on 3 January in the American review PHYSICS LETTERS.[2]

At the end of September, the Grenoble physicists had already achieved a record, reaching a critical temperature of 157 K in a mercury cuprate (Hg-1223, already), but subjecting the sample to a very high pressure: 235 kilobars. Like Paul Chu and his team at the Houston University, they used the fact that, in these cuprates, bringing atoms closer together (which can be done by applying pressure) will increase the critical temperature.

In November 1992, the Crystallography Laboratory had discovered the first compound of the family, Hg-1201 ($HgBa_2CuO_4$) with the collaboration of Serguei Poutiline of the Lomonossov University in Moscow, who was in Grenoble at the time.

The Grenoble researchers' samples measured about 10 cubic millimeters. The material in which the ESPCI team[3] observed a "resistive transition" at 250 K—i.e. a sudden decrease of electric resistance, "by a factor of 100,000," which led the researchers to believe that it involved a superconductive transition—was a bismuth

cuprate, of the BiSrCaCuO family (bismuth-strontium-calcium-copper oxide), deposited on a substrate in the form of a 30-nanometer thick film. In addition, the characteristics of the phenomenon—in particular its non-linearity, i.e. the anomalies observed in the current/voltage ratio (which normally increase [sic] in a linear manner)—"point to the existence in this material of a superconductive phase at a still higher temperature, which a few minor changes might make evident."

This result, an account of which was published in the American weekly SCIENCE,[4] was obtained through long and persistent research performed in collaboration at the Tel-Aviv University (Guy Deutscher), the Higher Normal School (Philippe Monod, Nicole Bontemps), the Pierre-et-Marie-Curie University (Julien Bok, also at the ESPCI), and the Institute of Materials Sciences and Radiation or ISMRA (Guy Raveau) in Caen.

Actually, back in 1986 a Surfaces and Superconductors team was created at the ESPCI; the following year, the team leader, Michel Lagues (with the support of Jacques Lewiner, scientific director of the ESPCI, and Julien Bok) decided to attempt the development of thin-film superconductors. To deposit these films on a substrate, one atom layer at a time, the ESPCI decided to acquire a machine that Riber, the French manufacturer of epitaxial facilities (which currently supplies 50 percent of the world market) took two years to develop, jointly with the ESPCI team.

Although the initial results were disappointing, which explains why many teams throughout the world became discouraged—actually, in cuprates, atoms are not always willing to cooperate and grow in a single plane (a phenomenon which Michel Lagues proposed to call "infinite phase" growth)—the team managed to master this method of "epitaxy through imposed sequence of atomic layers," which is continuously controlled by electronic diffraction, and they prepared their first sample, with three layers of copper oxide, and then, two years later, the present compound with eight CuO_2 layers.

The technique was covered by a patent application and a structure was set up jointly with Sofinnova for "the industrial implementation of this research." Although the diamagnetism of the sample remains to be verified (a difficult operation considering the thinness of the film, which tests the sensitivity of measuring instruments), the ESPCI seems confident. These results, they estimated, "should open a new field for the study of the superconductive properties of cuprates," and above all "should make it possible to achieve the goal pursued for 15 years by many laboratories throughout the world: to dispense with cryogenics, which until now was required to achieve superconductivity at normal pressure."

With the results of these two teams, the wild hope of obtaining superconductive materials at room temperature therefore seems to be taking shape. Although no "superconductor market" can be envisioned within the next five years, as Michel Lagues pointed out on 17 December, nevertheless huge long-term prospects are opening up in the low-current field, i.e. in electronics and data processing.

Footnotes

1. See AFP SCIENCES, No. 894, 7 October 1993, p. 16.

2. PHYSICS LETTERS, A-104, 3 January 1994.

3. Michel Lagues, Xiao Ming Xie, Hassan Tebbji, Xiang Zhen Xu, Vincent Mairet, Christophe Hatterer, Christian Beuran, Catherine Deville-Cavellin.

4. SCIENCE, Vol. 262, p. 1850, 17 December 1993.

TELECOMMUNICATIONS

Italy: Telecom Italia Companies Presented

MI2401100794 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 32-33

[Text]

Iritel Joint Stock Company

This was created on 8 May 1992 to manage the transitional phase that will lead to the constitution of a single administration. It will guarantee the continuity of services by transferring and retraining personnel who were formerly with ASST [State Telephone Services Agency] and PT [Post and Telecommunications] (about 12,000 people), and by creating the technical, economic, and organizational conditions for the successive integration of its own operational structures into the new system. It is the sole administrator of public and private telecommunications systems (including equipment installation and management), formerly done by ASST and the PT Administration. The telegram, electronic mail, and public telematics services carried out by post offices, national telex-data services and, until the relative concessions expire, those entrusted to SIRM [Italian Marine Radio Corporation] and Telemar, are excluded.

Iritel supplies the means of transmission within the national long-distance network for interconnection between the transit switching nodes of the SIP [Italian State-Owned Telephone Company] (SGT) network and between these and the national transit nodes managed by Iritel itself (for European traffic) and by Italcable (for intercontinental traffic). Furthermore it manages international traffic to and from Europe and the countries bordering on the Mediterranean basin, together with the relative equipment.

Italcable Joint Stock Company

This company manages intercontinental telecommunications services (telephones, data transmission, telex, cables, and new value-added services). Furthermore it participates in the study and realization of the more

important underwater cable systems. It is collaborating with partners in the Atlantic area to build a vast and complex network that directly connects North America, the Mediterranean, and South-East Asia. Its network is one of the largest and most diversified in the world and uses both cables and satellites in a balanced way.

It is quoted on the stock exchange and has a capital stock of 275 billion lire. In 1992, with 3,068 employees, its proceeds were 789 billion lire; investments totalled 120 billion lire with profits of 130 billion lire.

SIP Joint Stock Company

SIP—the Italian telecommunications company that administers national public telecommunications services—is responsible for customer relations. It guarantees the basic telephone service, with 23.7 million subscribers (in 1992) that will rise to 26 million in 1996, with a density of over 45 percent of the population. One subscriber in five belongs to the business world, whilst there are over 1 million mobile telephones and it is forecast that this number will double by 1996. There are more than 240 million kilometers of circuits under our cities and along our motorways and in 1996 about 40 billion communications are forecast, that is more than 75,000 per minute.

The primary goals of SIP are the modernization of the network and the management and maintenance systems, improvement of quality, and the introduction of new services (ISDN [integrated services digital network], intelligent networks, etc.).

It is quoted on the stock exchange and has a capital stock of 5.465 trillion lire. With 89,293 employees, in 1992 its revenues were 21.557 trillion lire; investments totalled 9.718 trillion lire and profits 461 billion lire.

SIRM Joint Stock Company

SIRM is involved in the installation, running, and maintenance of the radio stations that legally must be on board pleasure craft and ships bearing the Italian flag. In addition it sells various types of radio navigation aids. These are divided into two categories: those with a high innovative content for ships with large tonnage (satellite terminals and integrated navigation systems) and those that use the older technologies, for a wider and less professional market, such as the fishing sector and pleasure craft.

It has a national maintenance network with 10 operations depots and about 40 agencies in the principal coastal towns.

Telespazio Joint Stock Company

Telespazio—space telecommunications company—has the exclusive concession in Italy for satellite communications (telephones, television and data). It participates in advanced space programs and in the design and testing of new applications for satellites. It is developing the use of small antennas on dedicated networks and has over 400 completed installations. It is the first supplier in the world of telemetry services, and services for the management and control of satellites in orbit. It receives, processes, and distributes the data transmitted by Earth observation satellites (remote sensing).

It has a capital stock of 40.2 billion lire and has 1,130 employees. In 1992 its revenues were 348 billion lire; investments totalled 126 billion lire and profits 25 billion lire.

European Euro-ISDN Launched Without EU Support

BR2101092694 Bierges ELEDIS JOURNAL in English Dec 93 pp 1-2

[Editorial: "A Question of Competitivity"]

[Text] We are believers in the opportunity market that may be created by ISDN and so it appears are the national telecommunication companies (TELCOs) which shortly, before the end of this year, will begin to celebrate the birth of Euro-ISDN, Europe's ISDN showcase. In its most recent meeting, the European ISDN User Forum, which now boosts an average attendance of some 300 participants—mainly service providers, at its six-monthly rendez-vous, announced TELCOs plans for launching the special EURIE '93 week from 12-17 December.

The demonstrations, to run concurrently in all main European cities, will come to a head on December 14 when, in a live broadcast from Brussels, top European Union (former European Community) executives and Belgacom chairman, Bessel Kok, will discuss ISDN and map out its European future.

In another meeting, recently held at one of Europe's best-known universities, ERASMUS in The Netherlands, we have already tested for ourselves some of the promises of ISDN.

Live videoconferences and all forms of multimedia transmission (what will come of Electronic Trade Data Interchange?) are possible with a modest Apple and a 64 Kbits/s channel. Two channels offer much better quality of course. Cost? Not more than ECU5,000-6,000 (dollars approx.), computer and telecamera included.

But this is only part of the Pandora's box that may be opened up by ISDN. Consider the opportunities for teleshopping, telebanking, interactive television and other multimedia wonders. British Telecom is likely to be allowed to send movies to the homes of all who have a telephone. Analogue may offer patchy quality, but ISDN, through the very substantial advances made in the past two years in data compression technology, will certainly be up to standard.

In the meantime, whilst Europe is struggling to find its ISDN identity, other developed regions are not waiting on the sidelines. East Asia, Pacific countries and North

America are moving swiftly to be ahead of the game. Pacific Bell, one of the large United States "Bell" companies, has just announced plans, in line with the political motivation of Vice-President Gore, for the creation of the "super highways" data infrastructure, modernizing its California network with a fibre cable investment of some ECU16 billion. Forecasts are for some five million homes to be connected by the year 2000. To put this in perspective, that is more than all houses in Belgium.

Europe is also doing what it can, although, if one takes the recent announcement by Mr. Carpentier, Head of the powerful Directorate General XIII (Telecommunications, Information Market and Exploitations of Research), for a ECU90 million grant to help ISDN developments, one begins to wonder what sort of minimalistic policies Europe is beginning to implement. Sure, this is money that will go towards sharpening interconnectivity and convergence, but it is like spraying droplets of water on dry soil. Hopefully this will only be an interim measure, until the EU's Council of Ministers unblocks funding for some ECU13 billion for the next quadrennial plan for research and development in the European Union.

Still, as this money must be shared amongst all sorts of R&D, very little can be expected to be added to the ISDN pot.

It goes without saying that TELCOs prefer to address their investments to their own markets and may consider European needs as peripheral matters. Why release, for the common good, research and development effort that may give other operators a leading edge?

We must consequently accept with some reservations any claim that ISDN is fully available across frontiers. TELCOs' driving strategy may differ and so will the facilities that they provide. Full integration will be delayed by other important factors. Few European TELCOs aim to provide facilities wall to wall, something that would make ISDN really take off. France, the United Kingdom and a good part of united Germany may move perceptibly ahead, but most of the others show more than unwillingness to offer customers ISDN home-based facilities.

We, for one, resident in the capital of Europe, ten minutes by car from the headquarters of the powerful Directorate XIII, Telecommunications, will be unlikely to see the light of fibre optics in our office this century, if ever. Imagine the destiny of some of the more remote regions in this Europe of ours.

Then there is the problem of cooperation. We are all agreed that telecommunications knows no bounds, yet it looks as if the dismantling of those we have today may take sufficient time to ensure that we all become economically handicapped in the meantime. Size is the game of the next century: to have size, one needs alliances. It may be a shame that Europe's three giants (British, French and German TELCOs) did not manage to decide on a common penetration policy and have now gone their separate ways, forming two distinct blocks, one by the British Telecom and MCI alliance and the other codenamed Project Atlantic (French, German Telecoms and AT&T).

It reminds us of efforts, in the late 1970s, to try to bring Euro manufacturers, ICL, Siemens, BULL and Olivetti around the discussion table to form a Euro-venture. See what has become of them now.

Of course, there is always the spectre of Directorate General IV, the Competition Directorate of the European Commission, to remind us that such alliances create almost monopolistic situations. Let's wait and see.

Yes, we are believers of the opportunity market that may be created by Euro-ISDN, but we know that this will only be possible if it is given size, spread and funding to implement killer, multimedia-based applications. In short, a joint investment in hard Euro-cash rather than soft Euro-words at Euro-ISDN festivities.

ISDN Coverage—subscriptions—migration to EURO-ISDN (Status on 01 Jan 93)

	Territorial Coverage		No. of subscriptions		Migration to EURO-ISDN		
	BRA %	PRA %	BRA	PRA	Offering existing ISDN until	Offering EURO ISDN from	Tariffs fixed
Belgium	15	100	821	9	end 1994	1993	1993
Denmark (PTT Telecom)	-	-	-	-	-	-	-
Denmark (Tele Denmark)	100	100	1217	62	only EURO-ISDN	Jan 92	Jan 92
France	-	-	-	-	-	-	-
Germany	-	-	138831	11304	2000	1993	Apr 93
Germany (old Laender)	70	70	-	-	-	-	-
Germany (new Laender)	ded.cities	ded.cities	-	-	-	-	-
Greece	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-
Italy	37	37	1000	20	Nov 93	Nov 93	Nov 93
Luxembourg	-	-	-	-	-	-	-
Netherlands	10	10	400	15	1998	Jun 93	Apr 93
Portugal (TLP)	40	40	5000	250	end 1993	latest end 1993	latest end 1993
Portugal (CPRM)	-	-	-	-	-	-	-
Portugal (CTT)	-	-	-	-	-	-	-
Spain	10	10	150	-	-	-	-
UK (BT)	-	-	-	-	-	-	-
UK (Mercury)	-	-	-	-	-	-	-

Notes: BRA = Basic Rate Access; PRA = Primary Rate Access.

Germany, Ukraine: German, Ukrainian PTT Ministers Agree on Cooperation

MI1901123194 Bonn POST POLITISCHE INFORMATION in German Dec 93 p 5

[Text] The Federal Ministry of Posts and Telecommunications [BMPT] has concluded a memorandum of understanding with the Ukrainian postal administration on aid with legislation on the postal reform planned in the Ukraine. Dr. Laufs handed and illustrated to the Ukrainian delegation a paper on the assistance to be provided by the Federal Government in an advisory capacity. He pronounced the BMPT willing to tutor experts from the Ukraine in Germany. There is enormous interest in the Ukraine in laying and operating optical fiber lines for the trunk network, and a leasing model is being drawn up with DBP [Deutsche Bundespost] Telekom to finance the program. In parallel with the political talks, BMPT manager Masson discussed the issue of radio frequencies with Ukrainian specialists. Their talks covered openness in frequency allocation, licensing, and approval matters, charges, monitoring systems, and organizational and working procedures. Since its separation from Moscow, the Ukraine has had neither specialists nor data material at its disposal. Germany thus promised support with the technical preparations for the forthcoming world broadcasting conference.

The telecommunications sector in the Ukraine is much courted, and the United States, the Netherlands, and France are all trying hard to get a foot in the door for their companies. DBP Telekom, too, has permanent representatives in the Ukraine: Telekom holds shares in mobile radio and the digital overlay network, and has also trained 100 experts from the Ukraine. Siemens maintains a joint venture engaged in manufacturing its EWS [electronic switching system].

Italy: STET Three-Year Investment Plan Presented

MI2401144894 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 35-37

[Text] STET has just celebrated its 60th anniversary and has begun to make its "comeback" by establishing the basis for the development that will take place in the coming years, and that will see it playing a leading role in the most important change in the history of Italian telecommunications. It is an organizational and financial effort that has no precedents and is already being formed as a result of the law providing for the reorganization of telephonic services, the first tangible effects of which will be seen between 1 January and the end of 1996.

The document has still not been made public but some guidelines have been revealed by Managing Director Michele Tedeschi.

In brief, there are plans for an investment program that will have a total value of 32 trillion lire, and a growth in revenues of between 30 and 36 trillion lire per year, with the goal of reaching a telephone density of 48.4 percent in a context that is becoming more and more internationalized. These are the most important statistics of the "group program" for 1994-1996, that was approved in mid-November by the STET board of directors, presided over by Biagio Agnes. This period will be particularly demanding for the IRI [Institute for the Reconstruction of Industry] finance company, because of the reorganization of telephonic services to form a single operator, Telecom Italia, and the effects of this reorganization that will start to be seen within a market situation that is continually evolving both at home and abroad.

The sole operator, which will surmount the fragmentation of the five former concessionaires, will face the opening up of overseas markets following the abolition of the monopolies, the appearance of large foreign corporations, and the formation of new alliances that go beyond national and continental barriers.

The formulation of the plan is therefore coherent with the current trends of demand that accentuate the supremacy of market factors in a context that is increasingly characterized by strong competition. With the new organization, the Italian system, like those of the other major European countries, will be able to present itself on the services market with a structure that is capable of enforcing a strategy of a single offer and competitivity, with the prospect of reaping all the possibilities of growth in the telecommunications sector.

In particular, the constitution of the sole operator, the formation of which, it has been confirmed, will take place before September 1994, will permit its intrinsic synergies to be exploited. Consequently this will strengthen its position both on the national and international markets, and ensure the group a more favorable contractual position within the context of a global alliance.

Specific emphasis will be given in the new plan to client segmentation to be able to prepare the most appropriate response in terms of services/prices, particularly for business clients. The rapid strengthening of the network structure and the relative administration systems, the strong nationwide organization of customer services, and the evolution of the pricing structure, will contribute to this. In 1994, the latter in particular will already have the goal of gradually reducing existing mutual assistance to give greater competitiveness to the global supply system through the reduction of long-distance prices, and thereby start to catch up with the most advanced organizations at international level.

Therefore, in view of the fact that the program contract will be applied when the single operator is formed, the plan has been worked out on the basis of a price restructuring process that does not presuppose greater net capital contributions to the sector. The resulting benefits will be an improved utilization of the network and a more favorable market position.

These actions are part of a management plan that also foresees achieving a notable improvement in economic-financial strength.

Under this profile the program is characterized by a growth in the volume of revenues from the current 30 trillion lire to 38 trillion lire by 1996, and by overall investments of over 32 trillion, and a revenue situation that will be decisively better than that of 1993, the results of which were already favorable. It is also forecast that debts will be notably reduced thanks to the good progress of internal financing which, in the next three years, will be clearly in excess of requirements for investments.

As far as quantitative aspects are concerned the program provides for:

—An increase of about 1.5 million subscribers to the fixed network, 600,000 of which business subscribers; an increase of over 800,000 subscribers to mobile services; a density (subscribers to fixed and mobile services) that will reach a value of 48.4 percent by the end of 1996; and a final total of over 300,000 ISDN [integrated services digital network] equivalent connections;

—A development of national traffic for which a growth rate of 6.7 percent per year is foreseen, and of international and intercontinental traffic for which notably higher increases are foreseen (respectively about 12 percent and over 13 percent);

—Further technological updating of the network, continuing with the digitization of the exchanges (77 percent by the end of 1996) and the extension of optical fibers to the distribution network too. As far as the industrial sector is concerned programs are aimed at improving productivity and increasing foreign market penetration. Special emphasis has been placed on the complete integration of the Finsiel group to exploit the potential synergies of information science and telecommunications services.

Finally, the process of internationalization, which provides for investments of about 1.5 trillion lire, hinges on the acquisition of licenses to carry out services in areas of preeminently strategic interest as well as on the reinforcement of the supply system in an international environment through strategic alliances that also involve the industrial activities of the group.

Italy: Telecom Italia's Future Plans Described

MI2401143794 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 24-25

[Text] A workforce of 106,000 employees, 11.58 trillion lire in investments, 24.896 trillion lire in revenues from sales: With this identity card the companies involved in the reorganization of telephone services in Italy have faced 1993, the year that has seen them lead separate lives for the last time. In fact, at the end of December, the formal acts required by the Italian civil code for the constitution of the sole telecommunications operator, which will have its new organizational structure by 1994, will be completed.

Even if the new company, Telecom Italia, does not formally exist, the general lines for its development have already been traced out at STET [Turin Telephone Finance Company]. The plan for the next three years is not, as plans in former years have been, a "company" plan. It has been prepared as a "business" plan in view of the current situation. It is a group plan that will identify itself with the new operator plan. It is not the sum of various company plans, but a plan for a new integrated organization. It contains the basic directives and the stages of realization up to 1996.

Italian telecommunications have started to move in two directions in recent months. The first is the legal definition of the form of Telecom Italia, starting 1 January under the convention, and should in any case be finalized by next September. The second will establish the operational structure of the company, with the first three-year plan being constructed "in the laboratory." Though the companies are still separate, STET is busy preparing a plan which is based on the logic of a single organization and not on the simple coordination of autonomous programs.

This first attempt is the premise that will make the single plan operational for the next period: the three years 1995-1997. This will be the real organizational plan for Telecom Italia and will be created using this new logic from the beginning. The strategies are being prepared. Successively they will be verified by the units dealing with the individual products, and then nationally. The feedback will be put together to initiate the process of adaptation to actual market requirements.

To get an idea of the task awaiting the new single operator we should consider the fact that the number of telephone subscribers in our country will increase from 22.35 million in 1990 (with a density of 39.78 percent), to 25.19 million in 1995, and 29.83 million in 2000 with a density of 52.1 percent. According to forecasts, the percentage increase of subscribers over the decade 1991-2000 will touch 33.5 percent. In market terms, a total of ECU92.562 billion is forecast for the decade 1991-2000.

Telecom Italia is being set up to be the sole operator of all the services that are subject to controls at the present time. It is easy to see that when we get to 1998, with the complete liberalization planned by the EEC, the operational structures will have to adapt to the new situation. In fact, the operators for the services to be liberalized will either have structures that are based on existing divisions, or distinct entities will be formed.

The operator could have a structure based on operational divisions for controlled services, and perhaps have independent structures for the services that are not controlled. Telecom Italia will come under the STET holding company, so it will be alongside other companies (software companies, manufacturers, etc.). Relationships with the outside world, the general policy, and coordination will be defined at a holding level to make the maximum use of existing synergies.

The telecommunications world is complex so it is difficult to outline a definitive policy at this moment. For example, mobile radio services, that is small mobile telephones that are available today using structures of superimposed networks interconnected with the fixed network, still remain an open issue. It is necessary to define regulations for interconnection by evaluating both the technical problems and the economic problems (access charges and others).

In any case, with the liberalization planned for the coming years, the operator will be able to offer customers a "package" of services using a single system that is the result of very close integration.

Internationalization

Telecommunications is moving toward a world that has no frontiers. The most recent forecasts indicate that in 1995 more than half a billion of the 5.1 billion inhabitants of the world will be telephone subscribers, with a density of 11.68 percent. At the start of the new century there will be 5.4 billion inhabitants and the subscribers will increase to 723.4 million, this being a density of 13.32 percent. A percentage increase of 44.7 percent is forecast for telephone subscribers during the decade 1991-2000. Furthermore, processes are under way to open up markets for telecommunications services that will provide interesting prospects for the operators. These facts alone show that operators must undertake a process of internationalization aimed at reinforcing overseas markets. There are two roads that can be followed.

The first is tendering for licenses in countries where the system is being privatized. This type of participation would also provide the other members of the group with opportunities. For example, in Argentina, STET, having acquired the telecommunications license for the north of the country, is providing new openings for both manufacturers and for plant installation.

The second road is that of the problem of alliances with foreign organizations. This affects all the group, which operates in all areas of the information technology sector, and has areas of convergence between the operators of services, constructors of equipment, and producers of software. In the United States, a colossus like

AT&T allies itself with various local partners to offer its own services/products on a world basis. In this context the goal of the operator must be to "serve" business clients, and in particular the multinationals, with a new supply capability. That is to say the operator must be capable of satisfying the communications requirements of its clients with technical commercial structures, and with a portfolio of products/services that can satisfy a demand that is becoming more and more personalized, and that as far as geographical dimension is concerned, often goes outside national boundaries. It is a process that will become more and more important in the world of the future and that will cause a major ferment in the new markets. For this reason the sole Italian operator has launched its own policy of internationalization, as the major operators throughout the world are trying to do. It is an obligatory choice in order to face the opening up of the markets, in which the competition tends to acquire the richest parts, given that the market cannot be defended by staying at home.

Telecom Italia, like the other operators, must rapidly insert itself in international alliances where the goal is to protect the world market that will no longer be regional but global at the end of this decade following liberalization.

The choices are:

1) To have local distribution agreements for the services of third parties;

2) To be one of those operating at a global level, constructing services together with other administrations.

The Italian telecommunications system is classified sixth in the world for volume of business. Because of its size and what it can offer, it cannot remain limited to its own country. The Italian operator cannot just be a distributor at a local level. It must enter into alliances with partners who will contribute to increased competitivity at a world level in order to protect its clients at home, to acquire shares in international markets, and to carry out the role of a global operator with an infrastructure, commercial network, and portfolio of products/services that enable it to acquire competitiveness worldwide.

The policy of alliances has been pursued for some time by other countries, and from now on it will be a point of fundamental importance for modern operators. We cannot wait until Telecom Italia is ready with all its structures: for this reason work is already being done so that the new operator can start off with a precise direction for its actions in the international market. The network of alliances should therefore be operative when the new sole operator is officially formed.

An essential point is the choice of partners. It is necessary to choose partners that have common objectives, in order to combine capacities and resources, and to be able to increase presence on the market. The characteristics of individual operators should be taken into consideration when seeking partners to bring complementary activities together, thereby attaining greater competitive strength.

If Italy is to retain its place within the "group of the seven most industrialized countries" the Italian telecommunications system but must be an active, not a subordinate, partner in the new initiatives. It must play a role of equal dignity in the game of alliances that is being defined and must build up relationships with the goal of offering global services: This will start in the first instance with an agreement between operators. Then it will be possible to think about successive agreements with other bodies (for example in the software sector, etc.), to extend the competitivity of the group, utilizing the synergies of an integrated system like STET.

The STET group is looking at the future as a challenge that is presenting itself at a moment that is rich both in opportunities and in threats. The opening up of world markets, and their complete liberalization, are fundamental elements characterizing the new scene in which the operators have to move. The STET group, understanding the size of the problem that has to be faced from an organizational point of view, and the strategic choices that are necessary, has already started to introduce greater efficiency and productivity on the operational structures side and to also acquire greater competitivity for the entire range of its products/services through alliances that can ensure suitable complementarity.

International Affairs: EC Satellite Ruling Set To Rouse U.S. Anger

BR0802093094 Hampshire INTERSPACE in English 21 Jan 94 pp1-3

[Unattributed article: "The EC's Directive on Satellite Communications"]

[Text] The EC has issued its draft directive on the mutual recognition of satellite licenses. The draft directive is aimed at the markets for such activities as provision of FSAT services, MSS services and SNG.

A major change from previous proposals from the EC is the addition of a one stop shopping procedure in the directive, replacing the concept of a single community license issued by the Commission. This reflects what has actually happened at national level over the last two years. Whilst the Commission clearly wants a mechanism which provides licenses that are harmonised and fully recognised by all member states, the transitional one stop shopping procedure reflects the reality that this will be slow and difficult to implement. It also appears to reflect a shift of power away from DG XIII to CEPT and national level.

The Commission hopes that the transitional concept of one stop shopping will be replaced over time by "appropriate harmonisation conditions".

The document is largely silent on the issue of direct access to Eutelsat and Intesat—"As concerns the discussions in the International Satellite Organisations... on improvements to the access conditions to the space segment capacity of their respective intergovernmental

satellite systems, this proposal builds on the progress of these discussions and in particular the recent decision by the Eutelsat Assembly of Parties to propose the Member States options for improved and broadened access either through the installation of a national Signatory Affaire Office and/or through the so called multiple access option in which access to the capacity can also be sought via Signatories other than the national one. The proposal foresees that both options shall be implemented and recognised."

The position is a significant shift from the 1990 Green Paper which explicitly called for EC action to ensure direct access to Eutelsat and Intelsat. However, the EC says that the draft directive now "further builds on the discussions and decisions taking place within the International Satellite Organisations and in particular those within the Eutelsat framework."

An indication of just how slow the Commission has been in this sector is that the Green paper was issued (after much delay) in November 1990. The final directive is planned for implementation no later than 1 October 1995. Trade sources suggest that this is a tight timetable given that European Radiocommunications Office (see later) has other greater priorities than satellite communications; it is unlikely that the Commission will have its act together until well into 1995.

Power to CEPT

The draft directive calls for a major CEPT role in implementing the harmonisation of licensing conditions for satellite services as distinct from the interim one stop shopping set up. CEPT represents all European countries, not just the 12 members of the European Union. The draft calls for two CEPT bodies to have a role, the European Committee for Telecommunications Regulatory Affairs (ECTRA) and the European Radiocommunications Committee/Office (ERC).

"As a first step, ECTRA may be mandated by the Commission to elaborate the technical basis for harmonised licensing conditions, based on the expertise of ECTRA and ERC, in the wider European context, and as such appropriate to satellite communications. The technical basis could include matters such as arrangements for the coordination of frequencies or for site approval, verification of space segment access arrangements, issuing of network numbering schemes, practical arrangements which facilitiate contacts with prospective licensed satellite network operators in case of an emergency, practical adherence to specific national conditions in conformance with Community law etc."

"As a second step, the Commission will test the provided technical basis against Community law and policies, in particular telecommunications policy; after which common licensing conditions will be adopted. In accordance with the responsibilities conferred on the Commission by the Directive."

One Stop Shopping Timetable

Fairly tight timetables are set down for the issue of licenses under the one stop shopping arrangements. When a service or network provider files with a national organisation for a license, that organisation must notify national regulatory authorities involved within seven days.

The national regulatory authority responsible for issuing the license must take a decision and inform the applicant within six weeks of receipt of application.

LEO's

The draft also addresses the issue of new service categories for which harmonised Community licensing conditions have not yet been agreed, such as services from non-geostationary satellites and in cases where certain satellite services might not be covered by any of the established service categories due to the uniqueness of the service for which a license is sought. Under such circumstances, applications for mutual recognition can be dealt with under transitional one stop shopping until harmonised conditions for the service category in question have been elaborated.

The Community Telecommunications Committee (CTC)

The EC intends to use the CTC as the vehicle to implement the directive at Community level. The CTC is composed of representatives of national regulatory authorities of EU member states. However, most of the major tasks of implementation of the directive will be taken at national level. The CTC will also be used as a conciliation body when appeals are made to the Commission.

Bad News for the USA

The Directive will give rights to satellite service providers or network operators only if they are owned through a three quarters majority ownership by member states and/or national of member states. "That means that a US owned SNG operation, for example, could be forced to continue to obtain licenses at national level and have a separate license for each of the 12 member states. In practice it looks to be more of a vehicle to keep U.S. common carriers out of the European marketplace. Indeed, European organisations are currently specifically prevented from obtaining common carrier licenses in the USA.

The draft directive states that the protectionist measures "will remain to be applied until satisfactory completion of bilateral or multilateral agreements which allow a more balanced developments, or until the developments of the satellite sector requires a review of these provisions...."

Essentially this is a GATT services issue covered in last month's final meeting or the Uruguay round.

It appears that the clauses are likely to lead to a lot of lobbying by US interests.

Germany: Berlin-Bonn Datalink Proposed

94WS0033A BERLIN INGENIEUR DIGEST in German Oct 93 p 28-29

[Text] The government's move from Bonn to Berlin must not allow political tourism to explode. Telecooperation and a multimedia datalink are supposed to keep the travelling frenzy within bounds.

Albert Noltemeier refuses to accept at least one argument from those opposed to the government's partial move from Bonn to Berlin: "Effective cooperation is also possible over great distances," maintains the expert from the Society for Mathematics and Data Processing (Gesellschaft fuer Mathematik und Datenverarbeitung mbH, GMD) in Sankt Augustin near Bonn.

Noltemeier knows what he's talking about. The national research institute itself has long been testing work in "distributed organizations." As early as last summer, the society set up more than 30 teleworkstations at its headquarters in Schloss Birlinghoven and in locations in Darmstadt and Berlin. The datalink functions via telecom's switched broadband network with a bandwidth of 140 megabits per second. The workstations are each equipped with a computer, audio and video accessories, and the necessary applications software.

This is testing the future of the "innovative Bonn-Berlin datalink" (Informationsverbund Bonn-Berlin, IVBB), developed for the Federal Ministry of the Interior by the GMD together with partners at universities and in industry. The project bears the name POLIKOM. The term is a combination of the Greek polis (cities) and communication. Prof. Dr. Dennis Tsichritzis, GMD's chairman of the board, sees implementation of the link as an "outstanding opportunity for the exemplary use of cooperation and communication technology in Germany."

POLIKOM, for which the federal government will spend at least 120 million marks by 1997, should give Germany a leading position in the area of multimedia technologies. Economic researchers estimate that the market for high speed communication systems will boom. With components for this technology, sales could grow from almost $20 billion to about $55 billion by 1997.

US President Bill Clinton declared the national networking of the states with data connections as being among the most important tasks in building up the infrastructure. Total cost: $500 billion over 15 years. Whether or not Clinton can mobilize these gigantic sums in view of pressure to cut costs in the American budget remains to be seen. Germany, however, with Bonn and Berlin as separate seats of government, needs a modern communications link. Industry is also urgently seeking possibilities for faster data transfer.

And in a united Europe, it would be almost essential for survival. "European integration will put demands on all forms of government to coordinate and integrate their functions," says Dr. Nigel W. Horne of KPMG Management Consulting in London. However, this sort of cooperation and communication can hardly succeed with today's methods, which, along with telephone and fax, are characterized in particular by automobile, airplane, and train travel. In Great Britain alone, according to a traffic study, job-related car travel amounts to about 170 billion kilometers each year. Depending on the size of the company car, that corresponds to billions of liters of gasoline, which, moreover, are increasingly often frittered away uselessly in traffic jams. Horne is not the only one convinced that "effective communications systems, which reduce the need to travel, can contribute to energy conservation."

POLIKOM managers have already outlined a scenario of how that could function: A member of the Bonn Bundestag who wants to lead talks in his district, see how construction is coming along in Berlin, and take part in a committee meeting usually needs two to three days to do it now, suffers a lot of stress, and travels many kilometers. With POLIKOM technology, the representative could manage this all in a single day, largely stress-free and without having to leave his office.

Telepresence and telecommunication are the technical terms for this. In the future, says Dr. Josef Schaefer, program manager of the project, telepresence techniques should make it possible "to hold working meetings with participants in different locations using the same databases, transparent presentation media, and with joint work on the same document." That is far more than today's videoconferences already offer.

Figure 1. Telepresence: Collaboration hundreds of kilometers apart. [Figure not reproduced]

In general, the systems must assure the exchange of information between partners in different locations, facilitate collaboration between widely scattered sites, and support the cooperation of groups over relatively great distances.

Through joint viewing of documents, telepointing, and joint editing, mediated by data lines, this should operate as if the coworkers were sitting in a single building on several different floors, as commonly happens today.

In telegroup work areas, it must be possible for discussions to take place in which everyone has rapid access to the same archives, records, and documents. Personal teleworkstations should facilitate rapid contact with each other over hundreds of kilometers at any time.

In this way, telecooperation, the shared performance and coordination of tasks, should become possible. In POLIKOM, a sort of personal assistant is supposed to organize tasks, manage and monitor deadlines, and perform secretarial duties. Information can be obtained

quickly from a multimedia archive. Encoding functions and electronic signatures should provide for data security.

Figure 2. Datalink: Multimedia documents from the electronic archive. Features include: decentralized information sources; records and written document management; multimedia archives; organizational knowledge bases and other sources of information; distributed telecooperation workstations; personal files; data switching; network access. [Figure not reproduced]

All are functions which are available at least in the early stages today, but which must still be integrated into a whole. In today's prototypes of POLIKOM teleworkstations at the GMD—cost per workstation about 50,000 marks—some of these functions are already being tested: video-tools, multi-media-mail, an organizational knowledge base, an activity assistant, or the security system SECUDE with chip card terminals for electronic signatures.

The technical basis of the system will not only be cheaper in the future, but also considerably more powerful. The most important point however: The systems must be so reliable and easy to use that they are accepted.

This is what GMD wants to test in practice. In the Cologne-Bonn area, it is currently working on a project in the area of industrial development. A structural development company, founded in 1991 on the basis of the Berlin resolution, is to insure the future of the region together with several industrial developers—soon supported by multimedia functions and telecooperation.

Germany: Participation in Polar Studies in Antarctica Reported

94WS0033B BERLIN INGENIEUR DIGEST in German Oct 93 p 31-32

[Text]

Arctic Fusion

The ozone hole, the greenhouse effect, and climatic catastrophes continue to bring the Antarctic publicity as a crucible of weather. The fusion achieved between former East and West German polar researchers caused less of a sensation.

Polar researchers at the Alfred Wegener Institute for Polar and Oceanic Research Bremerhaven made out well during "ceiling control," which in plain English means last year's freeze on national research institute budgets by the BMFT (Federal Ministry for Research and Technology). Mention of their participation in the international Global Change Program, which is aimed at studying global environmental change, protected them from the red pencil.

The Germans can make a traditionally significant contribution to tracking down global changes, especially in the Antarctic. In 1976, GDR researchers set up their own research station to study solar-terrestrial relationships in the Schirmacher Oasis in Queen Maud Land, which later was given the name "Georg Forster." After the conclusions of this program, isotope physicists and chemists from Leipzig, geologists from Potsdam, and geomagnetists moved in.

The first Federal German station, "Georg von Neumayer," was built in 1981. With the German-German fusion of polar research, the question arose whether and how operation of the stations should be continued. Result: "Forster" is being renovated, but in the future it will only be used as a summer base. The budget afforded no more, especially since the old Neumayer station on the Ekstrom shelf ice in western Antarctica had to be given up and replaced by new facilities in 1992.

What too seldom works out in other cases went well here. East German polar research was given an exceptionally positive assessment by the Science Council. AWI director Prof. Gotthilf Hempel, chairman of the evaluation committee, even raved about "a pearl of former GDR Academy research." There was no duplication of West German goals. Structurally, of course, there were adjustment problems. Earlier, a maximum of six staff members of the Academy's Central Institute for Geophysics in Potsdam prepared and coordinated the expeditions logistically. Scientists from various institutions carried out the research itself. After unification, it was decided to expand the Potsdam working group to an AWI research center. The staff was increased to 40, 20 of whom are scientists.

Corresponding to the marine specialization of the AWI parent institute, continental activities went to the Potsdam group. In addition, atmospheric research using radio-equipped weather balloon ascents, radiation measurements, ozone exploration with lasers, and spectroscopic detection of aerosols are increasingly being undertaken. One group of the Bremerhaven scientists involved with this area has moved to Brandenburg. "Certainly the long tradition of East German research on the Antarctic atmosphere influenced this decision favorably," believes research center director Dr. Hans-Wolfgang Hubberten. GDR scientists, he acknowledges, "were the first to measure the vertical structure of the ozone hole continuously with balloon probes." This longest and most complete series of measurements will be continued in the future at the Neumayer station. "But aerological investigations as well as total ozone measurements on Spitzbergen will be made and evaluated by us," says Hubberten. His goal: To maintain the good image of the Potsdam research center and to polish it up with new ideas and findings.

Germany: Siemens Researchers Develop Neural Net

94WS0033C BERLIN INGENIEUR DIGEST in German Oct 93 p 32

[Text]

Synapse is Faster

Neural networks for specific applications on conventional computers are already marketable. The trend is towards universally applicable neurocomputers made of special hard and software. Siemens researchers have developed such a high-power computer.

The modern broker no longer depends only on his nose. Nor must he rely on the supernatural. The computer forecasts stock trends for him with greater probability.

Conventionally structured computers must suffice for such tasks. Complex interrelations of this sort cannot be completely described mathematically. The usual devices with von Neumann architecture can only process given algorithms sequentially, and then only if the input information is complete.

It is precisely this handicap which is overcome by specific software which imitates the functions of the human brain, the neural network.

The brain, working together with nerve fibers and sensory organs, can comprehend and classify things, even if the input information is incomplete. The information is stored associatively, i.e. in specific interrelations. This makes the brain capable of learning. Since it builds up its connecting structures itself in accordance with actual conditions, it is also self-organizing. Millions of neurons work as active processors, linked by nerve fibers (axons) terminating in contact points which are connected in parallel to each other. In the brain of an adult human, there are approximately 10^{13} such synapses.

A neural network imitates brain function in a greatly simplified fashion using mathematical algorithms. Like its human counterpart, it is capable of learning and can thus be trained to recognize specific patterns. Numerous models were developed for this, from the simple algorithm with hardwired neurons to models in which the connections are formed by self-organization.

First generation applications like the stock market forecaster mentioned in the introduction run on powerful workstations or other conventional computers. However, real time processing of language, processing of moving images and complex controls can no longer be carried out in this way. Therefore the trend in hardware is towards special components and chips (ASICS), which are significantly faster.

Heretofore, solutions have been tailor-made for special uses and have not been universally applicable. Therefore, at the Central Research Department of Siemens AG in Munich they have gone one step further with a two-year project on the SYNAPSE-1 neurocomputer.

"Our goal," says the director of the development team, Dr. Ulrich Ramacher, "was to build a neural special computer on which the simulation of any desired neural networks and learning algorithms is possible." The Munich researchers have used a new system architecture for the neurocomputer, developed the MA-16 signal processor, and created their own software. Prior to this, various network models were analyzed. Dr. Ramacher: "The analysis showed that there are 25 different compute-bound basic operations for which it is worth developing a special chip. That is what we have done."

The result is the largest pure logic chip developed at Siemens. It has 610,000 transistors on an area two centimeters square. Its more than 200 connections and clock frequency of 50 MHz allow an input-output rate of 10.9 gigabits per second. At the same time, the architecture of SYNAPSE-1 was so designed from the beginning that processor performance and memory size can be adapted to specific applications.

Dr. Ramacher is proud that SYNAPSE-1 is at least 8,000 times faster than conventional solutions. One hour of computing time on the neurocomputer corresponds to 8,000 hours on the latest SUN-Workstation. At this year's CeBIT in Hannover, Siemens researchers showed a sample application in which eight incomplete images were reconstructed in 62 milliseconds. For one such image, a workstation would have taken longer than two minutes.

Germany: Laser TV Prototype Described

94WS0123A Berlin INGENIEUR DIGEST in German Oct 93 p 26

[Article by Guenther Ludvik: "Beautiful Bride"]

[Text] A dream becomes reality, exults Hans-Juergen Thaus, chairman of the board of Schneider Rundfunkwerke AG, Tuerkheim. Home movies "with a screen measuring in square meters, which shows even the smallest details of the picture with unimagined sharpness and the whole range of colors."

It will be a few years until this happens, however. Initially, the 50-man development crew at Schneider in Allgaeu presented only a prototype of the new television generation, after five years of work and expenditures amounting to double digit millions. It works with expensive gaseous lasers and needs a cooling unit the size of an armoire. Although not ready for the market for a long time yet, the technological achievement itself is described as "considerable" by entertainment electronics giants. The industry is urgently in need of innovations in order to revive the market. In Germany, after the unification boom, sales of color televisions dropped from 5.75 million units last year to no more than 5.5 million this year.

Laser TVs, although not an entirely new idea, would arrive right on time. The technology sounds simple but it is bulky: Using a red-green-blue laser beam bundle, a projector shows colored images on a screen, analogous to today's picture tubes, in which electron beams are modulated by the video signal and conducted in rows across the screen. However, precisely this control is causing problems with the laser technology.

What works in the picture tube with changing magnetic fields does not work with laser light. It can be done with mechanical methods, such as mirrors, but the required speeds are extremely high. With an ordinary television picture the pixels write 25 times 625 rows per second, equalling 15,624 times across the screen. For HDTV [high-definition television] or flickerless 100-Hertz images, which are the future particularly for large-screen projection, they must be twice as fast. Schneider's R&D chief, Guenther Elster, and project leader Christhard Deter insist that they have mastered these technologies. However, the micromechanical know-how will not be revealed until all patents have been secured.

It is conceivable that small polygons will be used as mirrors, which rotate or swing around their axis. This beam-deflection technique requires intermediate storage of the image information in a digital memory, which passes them on in correspondingly modified timing to the laser. A great deal must still be done, above all for the laser technology. Only semiconductor-diode lasers can offer small size and low prices per unit. They have proved themselves in large-scale technology, for example in CD systems. "For the colors red and green the light intensities obtained today are already in the range of data specified for multilaser projection technology," says Professor Gunther Krieg, Dr. of engineering. For blue-light systems, however, "solutions can only be expected in the next two years."

Thus, the first projection units in video recorder format for DM 3,000 could be available three years from now, at the earliest, in the opinion of Hans-Juergen Thaus. Middle-size enterprises do not have the staying-power and, above all, the financial strength to develop laser projection until it is ripe for the market. Schneider is therefore looking for partners in the industry, but there is mostly skepticism. Many contracting parties have already been involved with similar technologies but given up. At least half a dozen other companies could also demonstrate that the idea in principle does function. But if laser TV were to break through, most would have to worry about their large capacities in the production of picture tubes or LCD displays.

Nevertheless, the PR show has had a positive effect for Schneider: The value of a share, which was introduced in 1986 at a price of DM 540 and which had meanwhile plummeted to DM 112.50, in early August climbed to DM 423. Thaus is now hoping that a U.S. company with a lot of capital will step in: "After the world premiere, the bride has become a great deal more beautiful."

EC To Propose 16/9 HDTV Format Directive

94WS0153C Paris AFP SCIENCES in French 25 Nov 93 p 11

[Article: "New EC Proposal on HDTV Transmission Standards"]

[Text] Brussels—The European Commission [EC] is going to propose a new directive (Europe-wide law) on high-definition television (HDTV) to promote popularization of wide-format television (16/9 width-height ratio) that will be applicable independent of the transmission standard used, according to Community sources.

This new proposal follows the Twelve's decision last June to promote wide-screen television in the HDTV action program and abandon any reference to a single, mandatory transmission standard. Initially, the Commission had planned to make the D2-MAC and High Definition-MAC (HD-MAC) standards obligatory.

The new proposal, to be submitted to member states on 7 December, provides that television services transmitted to viewers by cable, satellite, or ground-based broadcasting stations must utilize either D2-MAC or a transmission system 100 percent compatible with PAL or SECAM standards. Among other things, that should permit use of the German "PAL Plus" standard now under development.

For services not fully digitized, the Commission proposal endorses the HD-MAC transmission system. Experts expect digital transmission standards to evolve rapidly in the coming years. The Commission stipulates however that digital transmission systems will have to be "standardized by a European standardization body."

The proposed directive also says that "any wide-format (16/9) television service that is picked up and rebroadcast by cable systems must be rebroadcast in the wide (16/9) format."

France: Telecommunications Techniques, Prospects Described

94WS0238A Paris L'ARMEMENT in French No 40 Dec 93 pp 84-90

[Article by Pierre Fuerxer, Danielle Le Gourrierec: "Telecommunications Techniques, Prospects"]

[Text]

Perceived Need

In the Gulf War as well as in the landing in Somalia, news reporters had extremely advanced communications resources, at first glance, more advanced than those of the military. But those two examples—the tip of a deeply submerged iceberg—are not representative of all the events and their diversity. To set up their own communications, the military could not rely upon the technical,

political and economic opportunities that made possible the extraordinary media coverage of recent operations.

The military telecommunications system of the year 2010 will not entail the mere transfer of civilian solutions in gestation at France Telecom or in the research laboratories of the major French, European, U.S., or Japanese industries.

Civilian telecommunications currently are already displaying typical features of a basically market-oriented development. Areas having heavy population density or generating large volumes of traffic are and increasingly will be emphasized. Investments, too, will be concentrated on the most "profitable" communications services. In contrast, the military has to be able to communicate *from everywhere to anywhere and with anyone* . They will have to be guaranteed a full-spectrum leading-edge service no matter how heterogeneous the resources rendered operative. Defined in this way, their requirements are too varied to be met fully and directly by off-the-shelf purchasing of such products or civilian systems.

Civilian investments, however, are not comparable to those authorized by the armed forces. For this reason, if the military telecommunications system, a meta-system harmoniously and effectively incorporating the "fixed" segment and the "tactical" segments, relies on the humongous technological effort that the telecommunications industry has made, it will incorporate developments appropriate for meeting specific requirements.

Future Trap

Technological progress will lead to an unprecedented development of data exchanges. An easy way to conjure up tomorrow's telecommunications is based on France Telecom's Eurodisney attraction entitled *It's a Small World* . In a scaled-down world, the latter displays a host of individuals who spend virtually all their time on the telephone or watching cartoons. Will technology enable everyone at any time to have all the data that one could wish to receive at the risk of no longer being able to choose among the data that will be submitted to that individual? Will the military itself not be overwhelmed by the load of available data and, mesmerized by the data, become incapable of making decisions and taking action? Will the world of telecommunications be the golden age that humanity dreams of or will it be a nightmare?

Reduced Distances and Technological Innovation

In the near future all transmittable signals will be in digital form. The transfer rates necessary for the different services will be highly varied, going from a few bits per second to tens of megabits per second. The transfer rates needed for different source codings will be heavily dependent on the desired quality. Music coding will be done for transfer rates varying in a ratio of 10. For speech, the ratio will approach 100. For images it will exceed 1,000, including videophone and the high-quality television necessary for productive societies. The transfer rate for data transmissions, in turn, will be limited only by computer memory access times. The rapid escalation of communications capacity will lead to a considerable subjective reduction of distances. A distant correspondent will be as easy to reach as the neighbor down the hall.

Optical fiber is now being used in transatlantic cables. The TAT 9 cable that was put into service in 1991 between Europe and the U.S., makes it possible to transmit 560Mbits/s. In 1995, TAT 12 will make it possible to transmit 5 Gbits/s, that is, 60,000 telephone communications. In the laboratory, the National Center for Telecommunications Studies [CNET] is experimenting with a 20 Gbits/s 108 km link. For sure, before the year 2,000, 100 Gbits/s will be realized with multicolor systems, that is, employing several optical wave lengths.

Satellites will mainly be used for the broadcasting of images. For data transmission or telephone channels, the increasing congestion of the geostationary orbit and the saturation of the spectrum will increasingly lead to reserving the use of digital telecommunications satellites for covering the oceans and desert areas. Possible development of clusters of low-orbit satellites is not likely to check this trend.

It will be difficult to transfer this development into the military sector, nor is it certain that there is a real need to do so. The innovative technologies that will directly interest the military and impact its transmission system will be those being investigated for radio broadcasting and digital radio telephony for mobile units.

In effect, the features of the modulation that is used make it possible to counter radio channel distortions. *Digital Audio Broadcasting* [DAB], undergoing experimentation, will surely be the first application of that technology for digital radio broadcasting. It will therefore be possible on a single transmitter to multiplex six different stereophonic programs and to transmit 1.3 Mbits/s in a 1.5 MHz channel.

What is more, all transmitters broadcasting the same group of stations will use the same frequency. That will noticeably reduce the congestion of the spectrum and even do away with the concept of frequency plan. The same principles will soon be applied to television. It will be possible to transmit 5-20 Mbits/s in a current TV channel to fixed or mobile receivers. There too, multiplexing of several programs on a single transmitter will be possible.

Even if protection against electronic warfare might restrict the effectiveness of the subsets of a military telecommunications system using such solutions, the interest that such techniques could afford for broadcasting data to forces deployed in theaters of operation can be imagined.

Concurrently, mobile radio telephony will continue to develop. Systems like *Itineris*, based on the GSM [Global System for Mobile Communication] standard, will be supplemented by new systems occupying other frequency bands. Wireless telephones like *Bi-Bop* will be increasingly used. Wireless local-network and private switches will emerge. Ultimately, short-range links with mobile units will develop around various applications: navigation and traffic control, as with *Prometheus*, automatic toll collecting, or even detection of stolen vehicles.

To be sure, military systems will resort to the same techniques without necessarily realizing the same effectiveness since they will have to be shielded against the occurrence of electronic countermeasures and incorporate data security.

Frequency Spectrum Management

Frequencies are a very rare commodity. Civilian pressure on the military is already strong and could even intensify since the new market shares that use of frequencies currently allocated to the military represent for civilian operators are quite sizable. Besides the scarcity of military bandwidths, being side-by-side with a very large number of civilian systems and involuntary disturbance phenomena will require the introduction of a very strict management of frequency usage, transmitting powers and a very precise definition of radio equipment features.

Forwarding of Data

Conceivably, use of rapid packet switching technology or *Asynchronous Transfer Mode* [ATM], adopted in the combined forces *Socrate* system, will become widespread. All the data to be transmitted will be submitted in a single fixed-length format that is especially well suited for real-time switching. With the upsurge in data transmissions among computers, the required transfer rates will be increasingly large and sporadic.

The very broad heterogeneity of the channels making up the military transmitting system—optical fibers, satellite links, Hertzian link-ups—will be even further intensified by the presence of degraded modes during electronic warfare.

The switching system capable of optimizing the use of all such transmitting resources will be extremely complex. An increasing amount of transmission channel capacity will be dedicated to management data exchanges. In effect, it will require transmission of all the data needed for operating the services proposed for users and system supervision. In military systems that are simultaneously adaptable, reconfigurable in real time shielded against intrusions, the development of switches will be especially difficult. In fact, the switching system will be a major shared computerized application. Already in *Rita*, the option made was to make the software more complex in order to facilitate deployment of the system and its operation. This trend will be continued with ease of operation for the user always being the underlying parameter to be emphasized.

Civilian Sector Services

Standardization of transmission channels combined with increasing software programming is going to lead to a diversification of services. Initially, source coding will be increasingly suited to each application: wide-band sound, video-conferencing image coding, color facsimile coding, etc. A number of those signals could be combined in a transmission channel to create a multimedia service.

Subscriber mobility, a service originally offered by the lone tactical system *Rita*, will become a reality in civilian systems and all military systems.

An apparently complete freedom of movement for subscribers will result from the development of Hertzian link-ups.

At present, systems having a shorter range like Bi-Bop are surfacing. Micro-cellular system design with a 200 m or less close-in range is emerging. Its short range is offset by the universal availability of terminals for connecting to an optical fiber based wire system. Since users are unaware of the constant changing of their connecting terminal they therefore have a feeling of absolute freedom in their movement and the impression of an unlimited range for their portable telephone.

To conjure up the impact that the telecommunications development could have on our lifestyle, let us imagine a Parisian on vacation somewhere in the heartland of France in the year 2,010. His car's on-board computer takes him unswervingly to the sight, described in his travel guide, that he decided to go admire. On the way back to his hotel he decides to take a route through the woods. Covering hardly 100 meters, an alarm points out to him that he is no longer on a listed roadway. A few meters further on, his radio telephone informs him that, without a satellite terminal, he has lost all "civilized" contact and will not be able to be rescued in the event of an accident.

What will the effectively developed services be? Will they help improve the quality of life? Those are the real stakes in this impressive technological development. What will the behavior and reactions of the military personnel be, who, in civilian life will be "conditioned" by such an environment? The outlook in this sector continues to be quite difficult!

Specifically, Military Services

In the military systems, the impressive transmission capabilities made possible by the technology will facilitate broadcasting to the lowest command levels, even to the troops, intelligence in the form of texts, sounds, or images. Command systems likewise will be able to receive all the data they will need. In exchange, such systems will have to merge increasing amounts of data.

An increasing de-localization of functions will be noticed as well as the emergence of shared weapons systems whose elements, specialized by function, will cooperate for the extent of a mission. Already, during operation *Desert Storm*, computing the necessary elements for

aiming the *Patriot* missiles was done in the U.S. on the basis of data collected by the various available sensors. Is it to be feared that all decisions will be made by a staff, far removed from ground truth? Be that as it may, telecommunications flexibility will facilitate the development of designs for the employment of forces. But it should never be forgotten that electronic warfare will bare any blind alley or indiscretion made in the design stage and that there is no allowance for error.

If the geographic spread of conflicts requires increased interoperability with civilian systems, it will also be necessary to be able to dispense with local infrastructures that have been destroyed or that are in the hands of non-controlled elements.

Standardization in the Civilian World

In upcoming years, the intense creativity of telecommunications, on the digital signal processing level, equipment or systems and systems and services will engender two opposed movements. First, the proliferation of concepts will lead to the development of mutually incompatible technologies. It will be hard to choose among them. Second, the complexity of the systems will require the new products to adhere to precise standards enabling their introduction into the systems. That holds for equipment as well as services even if the so-called "smart system" structure will ease their introduction by making it possible to export the necessary software in the servers.

In the civilian world, the "deregulatory" movement launched in imitation of the U.S., could lead to a diversification of technical options among competing operators. Absent a firm policy aimed at requiring systems interoperability, the result could be a lowering of the quality of service in the eyes of the customers. If the operators are dynamic enough, the emergence of de facto standards will be noticed, as in computers, and, with the interplay of alliances, the establishment of very large transnational groups on the international level. Otherwise, initial commercial failure will delay development.

In London, for example, cut-throat competition among four operators caused an initial attempt at introducing a BI-BOP type service to flop while it enjoyed absolute success in Paris. In turn, development of the pan-European GSM radio telephone demonstrates that voluntary awareness by all the economic players of the interoperability problems can lead to a major industrial and commercial success while allowing operators to multiply. Therefore, standardization is an extremely major stake in the future of civilian telecommunications.

In military systems the interplay is unquestionably even more complex. To hold down development costs, it has to be able to derive maximum benefit from the investments made in the civilian world while allowing for military specifications: security, confidentiality, shielding against electronic warfare. That is possible only if the military, considered as a minority operator, participates in one form or another in the elaboration of civilian standards. Too frequently, a haphazard selection at the commencement of the standardization process makes it easy or impossible later to adapt the products to military requirements. The basic options, therefore, should be made with an awareness of the case.

Unlike what happens in other sectors, in telecommunications, the definition of standards precedes the development of the prototypes. Systems or services conjured up the engineers are specified and then standardized before springing into existence. Except in rare sectors not involving interoperability, innovation no longer can arise from an individual initiative but from a consensus that is all the more difficult to realize because the interests of the different parties are frequently at odds. The ability to persuade, therefore, is becoming an essential quality in engineers, an indispensable supplement to their technical expertise.

Telecommunications already have greatly impacted our lifestyle. In the past, the telephone radically altered the relationships among individuals. Presently, the fax is transforming our work style by eliminating the mail carrier's delivery routes and abolishing delays in the transmission of documents. In the future, when the videophone becomes less expensive, it too will alter social behaviors.

In the civilian world, development will occur because of a compromise between the disorder stemming from the development of new designs and engineering consistency that is the only thing able to allow different correspondents wishing to communicate to make themselves understood. Development will no longer be limited by engineering possibilities, but rather by the slowness of the standardization process, the investment burden to be amortized or even the difficulty in realizing a threshold of profitability for a new service.

Military systems should supply quality services comparable in all respects to those offered by their civilian counterparts. Even more than in the past, those in charge of developing military systems will not tolerate anything less than total availability for the transmissions they will require.

Only military systems are designed to completely dispense with the support of local infrastructures. Equipment manufacture in small series and durable in a very hostile environment cannot be compared to unshielded civilian systems. On the other hand, they should be interoperable with them in order to be able to afford the military optimum effectiveness under all circumstances. Military telecommunications have to remain operational in a major conflict. They will benefit from the development of civilian telecommunications but there will be no correspondence between the services offered by civilian telecommunications and the requirements of the military. Therefore, the systems cannot be identical.

In this article terminals have been dealt with only through the intermediary of the services. By the year 2,010, what will the user interface look like? In a period of office communications what will the operational modes be that

will be deemed ergonomic by the next generation? A further unresolved issue: besides civilian systems, with what others will it have to be interoperable?

German ISDN Development, Links With Euro-ISDN Noted

94WS0206B Heidelberg NET—NACHRICHTEN ELEKTRONIK + TELEMATIK in German Dec 93 pp 569-572

[Article by Volker Fink: "Start in the Mass Market"]

[Text] The connection of ISDN [Integrated Services Digital network] had developed into a sought-after product on the German telecommunications market. The official startup of Euro-ISDN in December will give the digital network an additional boost.

In the past years a number of countries have introduced ISDN. But there were no extensive ISDN standards, so that various performance characteristics and features were being used for connections in the individual countries. Above all, local ISDN terminal equipment and applications were confined to use in each country, so that each country developed its own terminal equipment. The result of this greatly limited the marketing opportunities, which also led to low production numbers and relatively high unit prices.

In order to counteract these problems, 26 network operators from 20 European countries have committed themselves to introduce an ISDN based on a uniform European standard by the end of 1993. Telekom has also signed this agreement. It was determined that every network operator should offer both basic and primary multiplex connections. In addition, a minimum of services and performance features must be supported. Beyond that, however, every network operator is free to offer additional performance features, but he must use the international standards. The minimum range includes:

- 64 kbit/s transmission service (transparent transmission of 64 kbit/s without limitation),
- 3.1 kHz audio transmission service,
- transmission of the calling number to the subscriber called,
- suppression of transmission of the calling number
- digital information display through to the extension in telecommunications facilities,
- multiple number dialing
- interchanging at the passive bus of the multiple equipment connection.

With Euro-ISDN the user thus has the advantage in the future of being able to use a large, high-capacity, and inexpensive international range of terminal equipment.

It has already been established that this is not just a future vision. Thus, as of January 1994 Telekom will offer a modern Euro-ISDN telephone at the cost of not quite 300 German marks [DM], which can be used with all current Euro-ISDN performance features. Small ISDN telecommunications facilities at a cost of DM 1,000 will be available approximately in mid-1994, and many experts anticipate that the price of passive ISDN PC adapter cards will shortly drop to about DM 200.

Another important advantage with Euro-ISDN lies in the users being able to employ their ISDN applications and communications solutions without change in various countries, which greatly simplifies international communication.

Introduction of Euro-ISDN in Germany

Telekom began to implement Euro-ISDN in its network in August 1993. The only thing needed to make Euro-ISDN available is to change the software at the switching center. Hardware changes at the switching centers or the subscriber's network end is not necessary. The introduction of Euro-ISDN is so simple because international compatibility involves only signalling on the access line, the D-channel protocol.

For technical reasons the introduction of the new software can only take place in stages, however, so that Euro-ISDN will not be available nationwide until April 1994. In regions where the work has been completed, customers can already be connected before that. The startup of regular operation took place on 1 December 1993.

With the introduction of Euro-ISDN, Telekom will offer both the national (1TR6) and the European D-channel protocols (DSS-1) in its network. Each user can then decide whether he wants to use an ISDN connection with the national or the European standard. This applies to both existing connections and to new installations. The conversion takes place individually for each connection at the switching center. No changes are necessary at the network port. For connections between ports with various protocols, the conversion is carried out by the network.

How long national ISDN will remain part of the features offered will be determined mainly by market requirements. Telekom plans to offer the choice between ISDN connections with national or European protocols until the year 2000.

'Bilingual' ISDN Base Terminal

Due to the different D-channel protocols, a 1TR6 terminal unit cannot be operated with a Euro-ISDN port. Conversely, it is also not possible to operate a Euro-ISDN terminal unit with a 1TR6 connection. Since Telekom will offer both D-channel protocols simultaneously in its network, and the customer himself can decide which standard he wants to use, this limitation is not significant with only one end unit. This applies in particular to ISDN connections of telecommunications facilities and computer centers.

With Euro-ISDN Telekom will also offer a bilingual basic connection for multiequipment configuration (basic connection with passive bus), in which both standards are available simultaneously. For this a modified network port must be installed at the subscriber's which uses the European D-channel protocol toward the ISDN switching center and at the subscriber network interface (S_0 interface), in addition to the European D-channel protocol, also the 1TR6 protocol. This makes it possible to operate terminals with the national and European standard at the same time with one and the same basic connection.

Bilingual primary multiplex connections are not possible for technical reasons and are therefore also not planned. If a telecommunications facility is connected through several ISDN ports, however, some of the ports could use the European D-channel protocol and the other ports the 1TR6 protocol.

Services and Service Features with Euro-ISDN

With the introduction of Euro-ISDN, Telekom offers a spectrum of services and service features which are clearly above the minimum range required. There will be many performance features which are not in the national ISDN and which make new applications possible. Some performance characteristics will also have new properties which permit even more comfortable communication. An example of this is "multiple dialing."

This feature replaces the previously well-known "terminal selector character." With the terminal selector character it was possible to select each equipment specifically in the event several terminals are connected to an ISDN port. While in 1TR6-ISDN exactly 10 numbers are available in ascending order at a multiequipment port with the addition of another position to the ISDN call number, in Euro-ISDN up to 10 numbers can be defined as multiple call numbers. These can be any free numbers from the volume of call numbers at the switching center. This means that when changing over to Euro-ISDN the customer can keep his previous call number if he is already connected to a digital switching center. Basically, one can say that the service features of the national ISDN are connection-related, while in Euro-ISDN they are call number-related. For the user this has the advantage that he can use the service features for each multiple call number separately. Example: In rerouting a call, the entire connection is no longer transferred; instead, various rerouting destinations can be entered for each multiple number dialled.

Additional features will be added over the next few years. In addition to three-party conferencing, special mention may be made of "partial rerouting" which will be available after 1994/95. With this feature rerouting calls from telecommunications installations will be possible for each individual extension.

The "reserved permanent connection" feature (old name: semipermanent fixed connection), for which there is still no European standard at this time, will not be offered so far. "Three-party conferencing" will not be possible to use until the end of 1994.

Euro-ISDN Rates

Regarding ISDN rates it is necessary to distinguish between connection rates for basic and primary multiplex connections and for traffic rates. The traffic rates correspond to the normal analog telephone connection. For that it does not matter whether you call or send text, images, and data. There will be no service-based rates. Telekom thereby differs from some other countries, in which non-voice communication carries different and in part higher charges than voice transmission.

However, the Euro-ISDN connection involves a new product with new features. That is the reason why Euro-ISDN rates are different from the rates for national ISDN. Basically, there will be separate tariff items for a Euro-ISDN connection without features, as well as for all features which can be switched on separately. Telekom is obligated to do this based on directives from the Federal Ministry for Posts and Telecommunication and the EC Commission. For reasons of handling and clarity, two cost packages are planned in which ISDN connection and features are bundled. The two packages offered are called ISDN Standard Connection and ISDN Comfort Connection and are offered in the basic connection variant at DM 64 and 69. At these rates the basic Euro-ISDN connection is DM 10 cheaper than the national connection variant.

Access to X.25 Networks

Euro-ISDN will not only offer new performance features but also the foundation for flexible and inexpensive communication. An example of this is access to X.25 networks over the B and D channel of the ISDN connection, for which Telekom will create the preconditions based on Euro-ISDN. Access through the D channel of the basic connection is particularly attractive for many applications.

The D channel is basically reserved for the signalling of the connection. Information transmission in this channel is packet-oriented and takes place with a transmission speed of 16 kbit/s. Only a part of this transmission capacity is needed for signalling, so that the rest is available for transmission of "useful information."

An ISDN customer can thus operate his basic connection independent of the use of the B channels as a X.25 connection. The access through the D channel is suitable for transmission speeds of up to 9600 bit/s. For higher speeds a B channel must be used.

If a user would also like to utilize his ISDN connection as a packet network connection, he must pay for the use of this feature in addition to the monthly base rate for the ISDN connection. Connection charges in ISDN are not included in the present concept, but the rates for each X.25 network are added. Access through the D channel

of the basic connection will presumably be very inexpensive. As of right now, operation is likely to begin in the second quarter of 1994.

The intended technical solution primarily offers advantages for applications in which only small data quantities must be transmitted per connection and which also have other communications needs. Among them may be mentioned the electronic cash systems in retail sales or booking systems in travel agencies. The advantage is that the users do not have to acquire several different telecommunication ports for language communication and data transmission, which leads to more flexibility and, above all, savings.

UK: JANET Academic Telecommunications Network Expanded

94WS0206A Heidelberg NET—NACHRICHTEN ELEKTRONIK + TELEMATIK in German Dec 93 pp 556-557

[Article by Adrian Morant: "From Janet to Super-Janet"]

[Text] For a decade the local area networks (LANs) at approximately 200 universities, polytechnic colleges and research institutions in Great Britain have been connected to one another through Janet (Joint Academic Network). Janet was installed in the early 1980s, currently serves about 50,000 terminals and offers access to electronic mail services around the world.

This system is now being improved by means of the most modern optical waveguide technology so that in addition to its existing function as a news transmission medium it will also function as a future-oriented communications structure for the academic community. The new improved network by the name of Super-Janet is needed to support certain teaching and research activities. In addition to language transmission, they also require rapid data, image and video transmission. Super-Janet will not replace the existing network but expand it.

Powerful Overlay Network

The new network will not radically change the type and way in which scientists access decentralized data bases and routinely communicate by E-mail with their colleagues all over the world. But it will create a significantly more powerful overlay network, to which gradually more and more facilities all over the country will be connected. After the development of similar networks in other countries, new perspectives will open up on this level as well.

Dr. Robert Cooper, who heads the project for the Science and Engineering Research Council/Universities Funding Council Joint Network Team, regards Super-Janet as "singular in Europe." In explaining the pioneering role of the new network, he adds that it involves a test system for the demanding academic community.

The British Universities Funding Council (UFC) awarded the contract, worth 18 million pounds over a period of four years, to British Telecom (BT). In the first phase data centers at the Universities of Cambridge and Manchester, Rutherford Appleton Laboratory, University College London (UCL), at Imperial College London and the University of Edinburgh will be interconnected. In the course of 1993/94 about 50 locations will be connected to the network. Additional ones will follow, according to the availability of the necessary funds.

The network concept will be realized by means of the latest broadband technology. Most communications opportunities are based on the Switched Multimegambit Data Service Definition (SMDS) by BT. The Synchronous Digital Hierarchy (SDH) is to be used as a central network technology, which together with new broadband transmission methods (Distributed Queue Dual Bus, DQDB, and Asynchronous Transfer Mode, ATM) will offer a maximum of transmission opportunities.

Dr. Alan Rudge, head of BT's research and procurement division, who is responsible for all the company's technical research work, stresses that the broadband transmission platform used to interconnect the locations is just as important for the industry as for government offices and academics: "The Super-Janet order enables BT, together with the universities, to develop new applications which sooner or later will bring the companies a competitive advantage."

Dr. Rudge further refers to the necessity of promoting the image of "broadband as the standard." According to his information, BT is proposing to the industry that it should participate in joint projects with the suppliers in order to offer these facilities. A critical mass is needed in order to stimulate confidence. BT therefore expects that the availability of the network will have a decisive "trigger function."

Broad Application Range

Transmission of visual output data from extensive, fluid-dynamic calculations executed at the Rutherford Appleton Laboratory near London on a Cray YMP supercomputer to Imperial College in London is one potential technical application. Since the enormous amounts of data produced can only be processed by the user if they are present in image form—often with color and animation—Super-Janet offers the advantage that the researchers no longer personally have to go to the Rutherford laboratory.

The Cyclotron Unit of the MRC (Medical Research Council) at Hammersmith Hospital in London also have several facilities for producing pictures of the brain, which are of interest to researchers in other places. In the pilot project these pictures are transmitted for analysis from Hammersmith Hospital to the psychiatric departments of the University of Edinburgh and the University College London as well as for processing by the supercomputer center at the University of Edinburgh.

University College London has the equipment for teaching surgery by means of interactive video. For that reason a proposal was made to carry out a series of surgical demonstrations between the UCL and the other centers which are able to support interactive activities. These can be for example surgical demonstrations from the operating room, clinical demonstrations in the lecture room, discussions between surgical specialists, joint preparation of video-teaching material and investigation of possibilities to use existing teaching materials for self-study in a decentralized teaching environment.

Among the applications in the field of information services are preparation of archival documents and a test project for an electronic magazine, as well as a series of applications which require rapid transfer of voluminous data from one place to another. The former application is to demonstrate inquiry for and preparation of documents with the network. At least seven universities will participate in order ultimately to establish a regular service between the locations. This method is more economical than the existing slow and personnel-intensive borrowing agreements between the libraries.

Super-Janet will enable a multitude of projects—in the most varied disciplines—which are being postponed at this time for lack of a suitable fast network. Furthermore, with every successful application the advantages of Super-Janet are becoming noticed by an increasingly larger circle of users.

Lasers Used to Communicate with Satellites

94WS0186A Duesseldorf VDI NACHRICHTEN in German 10 Dec 93 p 20

["Optical Communications with Satellites: Carl Zeiss Jena Technology Supports ARTEMIS Data Transmission"]

[Text] VDI-N Jena, 10 December 93, M.S. - When the ARTEMIS satellite is launched in 1996, the ESA (European Space Agency) will make practical tests of the effectiveness of laser technology in providing communications between the space vehicles themselves and between the satellites and the ground station. In late November, Carl Zeiss Jena will have delivered the one-meter mirror telescope to be used for this purpose at the ground station situated on the Tenerife volcanic massif.

In three years, when the ESA's ARTEMIS research satellite, equipped with the necessary transceiver module, has been put into a geostationary orbit, one of the most promising projects of European space research of this decade, designated Silex (Semiconductor Intersatellite Link Experiment) will get underway. For the first time in the civilian domain data will be transmitted directly via laser pulses between the French Earth-surveillance satellite Spot 4 and ARTEMIS. On board each satellite will be a 25-cm receiving mirror and laser operating in the 820-nm light wavelength band. In addition, using the same system, ARTEMIS will also be able to transmit the signals received further on to the ground station in the Canary Islands. From the Canaries, the data can then be transmitted by light waveguide, copper cable, or radio, whichever method is preferred, to subscribers worldwide.

German companies, too, especially Carl Zeiss Jena, which is responsible for the optical elements in Silex, have received important contracts through Dara (German Space Agency) for this project that will, providing the general tests with ARTEMIS are successful, be continued from late 1998 with the first commercial communications satellites. On the occasion of the delivery to Dara of the telescope, Dr. Elk Zittow, business manager, stated frankly: "This has been an enormously important contract for our astronomical instrumentation branch, which is currently being rebuilt." The instrument, which cost roughly 2 million German marks [DM], is one of 14 contracts that the company is presently working on for the space program. It had been originally destined for an astronomical observatory in Kazakhstan. Since the original customer was no longer able to pay, Zeiss Jena modified the telescope for its new use. Anthony Dickinson, associated with ESA's technology center, sees many advantages in the use of laser light, which has already found many applications on the Earth. If free transmission is successful in orbit, not only would a reduction in energy use become possible through the better beaming of light but a greater degree of resistance to interference as well will be achieved. Moreover, the limitations on the available radio frequencies and their limited transmission capacity have compelled the search for such new approaches.

Dr. Fritz Merkle, Carl Zeiss business manager, expressed it this way: "An enormously important contract for our company, whose astronomy technology department, now being built up and directed in Jena, possesses technological know-how from both the West's and the East's space programs."

This participation in the European Silex Project is also a helpful contribution to the ongoing debate concerning Germany's competitiveness as a desirable industrial site. As Prof. Ralf Joachim, deputy business at Dara, put it: "In recent years there has been a double digit growth rate in the electronic satellite communications field internationally. Regrettably it has passed Germany by." Joachim continued: "We have to break away from our present 'sub-critical' presence in the ESA; the successful engagement in Silex provides grounds for careful optimism."

Space research and technology, which is sometimes criticized and repeatedly threatened by funding cutbacks, truly advanced economic developments, especially in telecommunications. In Prof. Joachim's opinion, satellite-based data transmission plays "a key role in maintaining and expanding the competitiveness of our service and technological industries." A study prepared by the Euroconsult Company estimates that the

world-wide market volume for civilian satellite communications systems will reach US$79 billion dollars in the coming decade, of which $55 billion alone will be for on-board systems. Of the approximately 144 new satellites to be built in this time frame, about 36 will originate in Europe.

It is Dara's conviction that German industry has—through its own efforts and with some outside funding—produced some outstanding achievements, such as Kopernikus, TV-Sat, and Symphonie, although, it must be admitted, with less satisfactory commercial spin-offs than hoped for. However, the competition remains very uneven because the United States and other countries can help support their space programs through high military development outlays and government technological programs. Consequently, German companies have to be especially innovative and advance new technologies. Optical communications represents one shining example of just such a new technology.

The ARTEMIS scenario, which ESA believes will become the reality after the successful conclusion of the test phase in late 1998, should bring urgently needed advantages for low-flying Earth reconnaissance satellites and for manned space flights as well. The ARTEMIS relay station will not only receive signals and transmit them in the conventional microwave manner to Earth, but will also ascertain whether the laser system will prove to be the preferred technique for reliable and rapid contacts and which frequencies are best. Finally, it is also conceivable that at some future point a laser optical system will also find use in distant missions. "We still do not know the practical limitations of this technology, but I'm convinced we will hear a lot more about it in the fullness of time," Dr. Fritz Merkle of Zeiss asserted. It is now quite clear that the laser system, by virtue of its lower power requirements, will permit the weight of communications equipment to be significantly reduced. This alone will open up completely new opportunities.

Closer at hand, of course, are the tests planned for late 1995, when the Tenerife ground station is equipped with the Zeiss telescope. The instrument, as Mario Lopriore of the Estec space technology center pointed out to ESA, will most probably also be used to search for space junk. An accessory CCD camera, using the optical system of the telescope, reportedly will be able to detect remnant objects from older satellite or rocket engines from the centimeter range.

France Telecom Tests Flight Telephone System

Paris AFP SCIENCES in French 9 Dec 93 pp 17, 18

[Unsigned article: "First Airplane Telephone Communications Using the TFTS System"]

[Text] Paris—On 3 December, France Telecom sent its first telephone communication using the European system TFTS (Terrestrial Flight Telephone System) from a Paris-Athens flight on Air France, according to a statement from the telephone carrier.

The TFTS system makes it possible to establish telephone communications—or to send faxes and data—from a plane to any country by means of automatic dialing. The air-ground link is directly established through specialized equipment aboard the aircraft and a cellular network of stations on the ground, each with a range of 240 km linked to the stationary telephone network.

At the end of 1990, France Telecom joined with several European telephone carriers to create a TFTS network that would gradually cover all of Western Europe by 1994. The telephone carriers are also working with six European airlines (Air France for France) which will begin full-scale testing early next year aboard their planes.

Germany Seen as Vanguard of GSM Mobile Radio Net

94WS0170A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Dec 93 p 8

[Text] The Information Technology Society in the Frankfurt League of German Electrical Engineers (ITG) regards digital mobile radio as a significant improvement in the position of Germany and Europe. They note that the Germans, in particular, not only played an essential role in the development of the new "Global System for Mobile Communication" (GSM) standard, but they were also in the vanguard in the development of the GSM mobile radio net. They also claim that a large percentage of Federal German territory is already equipped with radio stations for the D1 and D2 nets which use the GSM standard. By 1995, 95 percent of the territory should be included.

GSM is the prerequisite for mobile telephoning without borders: 28 countries, including the CIS, China and Australia, want to install GSM radio nets over the next few years. When that has happened anyone within these countries who has a GSM mobile phone can access the net and place or receive a call.

The technical prerequisite for the compatibility of the individual national networks is the GSM standard set by ETSI (European Telecommunications Standardisation Institute). It defines the processing of the digital signals at the interface, the division of the frequency band into channels, modulation and coding as well as the functions of the fixed radio stations and their regulation. In Germany these technical requirements were met with the activation of the D1 net. ETSI standardization is converted into the national standard by the German Electronics Commission in the DIN and the VDE (DKE).

Software for the complex GSM systems runs on supercomputers which in turn must be incorporated into the net. The nets are constructed in such a way that in the signal area every radio station can reach a maximum

number of subscribers simultaneously by mobile telephone. This is achieved by data reduction and by optimal utilization of the frequency bands by multiplex processing. The 137 frequencies in the 900-megaHertz band alloted to the GSM can each be utilized by eight subscribers. By multiple utilization of the frequencies at various points on the net an almost unlimited subscriber capacity is achieved. In the opinion of VDE-ITG, demands on mobile communications systems will continue to grow. Intelligent network functions will have to be developed for current nets in order to introduce a unified worldwide call number. Only then can the goal of "universal personal communication" be realized. Every subscriber should be able to access the network on any continent by card or telephone and be able to receive calls using the same call number in any country. By the year 2005 the European "Universal Mobile Telecommunication System" should be using an integrated system to provide the services of mobile radio nets which today exist side by side. Comparable efforts are being undertaken worldwide with the objective of creating a "Future Public Land Mobile Telecommunication System."

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France: New Shot-Blasting Techniques

Paris L'USINE NOUVELLE in French 2 Dec 93 p 67

[Article by Michel Vilnat: "New Lease on Life for Prestress Shot-Blasting"]

[Text] Development possibilities are opening up for shot-blasting thanks to very innovative techniques.

Shot-blasting, which consists of propelling small metal, glass, or ceramic pellets against the surface of metal parts to increase their resistance to fatigue, is finding wider applications. Teknoson, a new PMI (small and medium-sized enterprise) in the Paris region, has perfected a new method of propelling the pellets to their target. The parts to be processed are suspended in a metal bowl containing a handful of steel pellets. The bowl is connected to an ultrasonic generator which makes it vibrate at a frequency of 20,000 Hz. The pellets thus set in motion will impact the parts in a totally random way at approximately 20,000 times per second. Whatever its shape, the part is treated evenly. It is even possible to shot-blast hollow parts such as inlet tubing, where the shot enters through one opening and exits at the other.

The depth of the process can reach 0.8 mm, depending on the diameter of the pellets, the length of processing, and the power of the ultrasonic transducer. Jian Lu, an engineer at the Cetim materials department who has tested numerous samples prepared by Teknoson, emphasized that "the shot used comes from ball bearings. It is therefore very hard and perfectly spherical. As a result, the surface condition obtained is better than the one achieved with standard shot-blasting where the particles are not always round."

The technique developed by the PMI in Saint-Soupplets (Seine-et-Marne) is patented and was invented by a Russian scientist for the particular purpose of shot-blasting aeronautics parts and gun barrels.

In addition to these functions, the technique has the advantage of being very economical: it does not require much shot, does not need the installation of a shot-sorting system, and does not use up much energy. Prestress shot-blasting applications are very widespread: turbine blades, compressor vane footings, springs, tubing, and so on. Furthermore, shot-blasting can be used on steel or aluminum as well as on titanium. Because of the excellent homogeneousness of the process, thin parts do not warp. To achieve the same result, standard machines must use two nozzles at the same time.

By adapting the shape of the ultrasonic transducer, it is also possible to process hollow shapes such as rifle barrels. A part can very easily be partially shot-blasted if so desired. The surfaces to be protected just need to be covered with masking tape, which will absorb the energy of the shot without transmitting it to the metal. Teknoson specialists are already formulating further developments for their process. For example, by adding a powder to the bowl, parts could conceivably be plated. But in this field, everything has yet to be invented.

Measuring particle velocity is one factor in predicting the efficiency of a shot-blast operation. Until now, this parameter was very difficult to establish. To solve the problem, the Wheelabrator Allevard company, world leader in steel shot-blasting, has joined Helispire, a startup company specializing in measurement systems design, who has come up with the solution: an optical process called Travel.

Yves Lecoffre, head of technology at Helispire and inventor of Travel, explained that "until now, the only technique available was Doppler laser anemometry, a very complex method that is much closer to laboratory techniques than to industrial ones." Not to mention that the laser-based device is costly and must be operated by experts.

At present only enterprises like Snecma have invested in such an installation. Lecoffre pointed out that "our system makes it possible to efficiently measure shot particle velocity by simple means and at reasonable cost (about 120,000 francs)." His method consists of illuminating the measurement area with a rectangular beam of white light. When a particle crosses the beam, it sends the light back to a lens that is placed perpendicular to the light beam. This lens is fitted with a mask featuring two narrow slits of different dimensions. The travel time of the reflected light across the slits gives the speed and direction of motion of the particle. Better yet, by doubling the beam through a semi-transparent mirror and adding two more perpendicular slits, two components of velocity are obtained (one horizontal, the other vertical). The Travel device thus makes it possible to measure particles whose diameter size is of the order of 0.5 mm at velocities between 1 m/s and 100 m/s with a precision of the order of one percent. A computer system collects all the results and calculates an average velocity for the particles. As is only fitting, the first shot-blaster equipped with the Travel system is in operation at Allevard Wheelabrator, but future customers have already expressed interest in a machine equipped in this manner.

Germany: 'Virtual Presence' in Automatic Robot Systems Developed

94WS0171A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 27 Dec 93 p 8

[Article by Scha: "Controls for Robots"]

[Text] Dortmund—Under the direction of Eckhard Freund and in collaboration with the Action Association of NRW [North Rhine-Westphalia] Aerospace-Oriented Companies, the Institute for Robot Research (IRF) of the University of Dortmund has developed a new control concept for automated systems and robots by

employing "virtual presence" methods. The control concept is supposed to serve to make robot and automation systems universally usable. For this purpose, the working environment of the robot is graphically reproduced on the computer screen and the operator can carry out his assignment through the computer graphics with the aid of a so-called data glove. The IRF control technology then sees to it that the activities are carried out in the "virtual world" of the computer graphics—the transporting of objects, for example—are replicated by the robots. Conceivable applications with a commercial background in the space industry are, for example, the inspection and repair of costly geostationary communications satellites. Numerous applications for this "virtual presence" technology are also obvious outside the space industry, in the field of medicine, for example, to provide support for operations.

France's CEA Develops New Robot Prototype

94WS0175B Paris PRODUCTIQUE/AFFAIRES in French 30 Dec 93 pp 1, 2

[Article: "Robsyc Born of CEA Alliance With B + Developpement"]

[Text] The robotics unit of the CEA [Atomic Energy Commission], located at Fontenay aux Roses (Hauts de Seine), and B + Developpement, have developed a robot, Robsyc, capable of repositioning small objects accurately and rapidly. Robsyc is probably the world's fastest robot today over long distances—1.5 meters—owing to accelerations of 8 G, and is capable of handling randomly positioned containers weighing 2 kilograms, lift them by means of suction at the rate of 80 containers per minute, and reposition them in orderly layers at the rate of 8 meters per second. Its precision of plus or minus 0.5 mm is provided by a simple mechanism based on flat belting and capable of four degrees of freedom. B + Developpement (18 persons and annual revenue of 20 million francs) is located in Gemenos, near Marseille. It specializes in "mechanotronics" and works under contract on new designs of materials-handling robots. According to Gilbert Gras, a B + Developpement engineer, Robsyc's capabilities are essentially the result of the very innovative architecture of its command control system. To the classic "process + corrector" system, the CEA has added three model modules: inverse, observer-predictor, and behavior. The combination corrects, in real time, the difference between calculated and actual trajectories, by means of rapid computing cards based on distributed signal processing using industrial PC's. Today, Robsyc is a feasibility demonstrator prototype. In the coming months, B + Developpement will adapt it to multiple-object selective sorting (handling of wholesale pharmacist deliveries), and emboxing (depositing of products in cellular-like container or arrangement of containers) for the agricultural food products industry (fancy boxed chocolates, for example).

ABB Launches Two Robots

94WS0175C Paris PRODUCTIQUE/AFFAIRES in French 30 Dec 93 p 2

[Article: "ABB Robotics Launches Two New Robots]

[Text] ABB Robotics has launched two new robots: its IRB 1400 (5 kg) and IRB 2400 (10 kg). These are the first two products of the new line of robots developed by the ABB group under its customized approach to robotization. They feature 6 axes, operate very rapidly, and follow a trajectory with precision. "We know that the primary demands on the part of our clients boil down to reduced cycle time, the manufacture of a wider variety of products on a small-scale production basis, at a reduced price per unit. They also want customized integration of products, systems, and services. This is the feedback that has prompted us to develop this new line," says Guy Micoulet, president of ABB Robotics France. At the heart of the new line is the all-new S4 command console, which enables the user to rapidly put the robots into operation within his current manufacturing process, without delay, without any specific development of software, and without costly adjustments and fine-tuning. This new line also provides in advance for the needs of the manufacturing industries, through various innovations. The line includes a Windows-type operating system interface that facilitates communication regardless of whether the user is an operator, programmer, computer engineer, or systems engineer. It utilizes its own technology, and its language in the form of interactive dialogue is simple. The command console enables very precise adherence to trajectory at a high speed. Rapidity of movements is obtained through automatic optimization of control. The console utilizes a complete real-time dynamic model of the robot arm, enabling incremental accelerations and higher speeds of the arm. The command system always provides the optimum acceleration regardless of conditions of use; as a function, for example, of the position of the arm within the robot's work envelope, or according to the weight and inertia of the load taken on. The system also uses the robot's mechanical potential to optimum advantage. The duration of cycles is therefore shorter and productivity is improved. ABB Robotics will launch other new products and services as part of the new product line it is developing together with its clients. Its current gamut of products and services provides a platform that can be modified and adapted to keep ahead of the needs of industries beyond the next 10 years. The group posted a 1992 revenue of $350 million worldwide with personnel totaling 1900 employees. R&D accounted for $35 million of this revenue. Its activity in France generated a revenue of 162 million francs with 150 employees.

ABB Robotique - 22 rue du 8 Mai 1945, BP 118, 95340 Persan. Tel. (1)30.28.60.00.

LASERS, SENSORS, OPTICS

Switzerland: Single Atoms Viewed With New Cluster Technique

94WS0134A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 26 Nov 93 p 8

[Article by toz: "Atomic Cluster Formation Facilitates Production of Nanostructures"]

[Text] Frankfurt—Specific production of nanostructures is hardly possible with the masking techniques used until now, if one wants to produce future electronic switches with structural widths below about 50 to 60 nanometers. To be sure, using converted grid-tunnel electron microscopes scientists have been able to place single atoms in a specific spot on silicon surfaces. But this technique is slow, because only one atom at a time can be worked on, and it would be very expensive.

However, new research results by Swiss and North American scientists now indicate that there are various ways to build up metals, oxides or possibly other compounds as well in a controlled manner for functional electronic structures on silicon or metals.

A Swiss group of physicists at the EPF Lausanne (Institut de Physique Experimental, CH-1015 Lausanne, Switzerland) is using a guided separation process which leads to clustering or depositing on various surfaces. The surfaces absorb individual atoms, which by means of very precise regulation of the prevailing substrate and material temperatures gather into larger aggregations and finally into clusters.

In so doing the individual atoms act similar to crystallization nuclei in crystal growing. In these processes the atomic surface structure also plays an important role for the depositing processes, a "shaping, defining" role, so to speak. The physicists describe their work principle as "diffusion-controlled aggregation." In these processes the laws of depositing follow the kinetic behavior of the various materials.

It has been possible in the laboratory to deposit, among other things, several hundred Angstrom-long, strip-like lines of copper atoms on surfaces of palladium foils and cluster-sized silver particles on bases of platinum.

The results by the Swiss physicists are not yet suitable for immediate practical application. But they have discovered principles with which it is now possible to build suitable structures for simple, and later on also more complicated, three-dimensionally conceived, electronic components.

U.S. scientists at the NIST National Institute of Science and Technology in Gaithersburg (Maryland) have taken another approach. They use laser light in order precisely to deposit individual atoms. With their method they were able to build several three-dimensional tracks of chromium atoms on a silicon base, for example, which are a little more than 30 nanometers high and are spaced about 213 nanometers apart.

Right now their method functions with metal atoms which are directly applied with the laser beam on the bases. In so doing the excited metal atoms "ride" on the laser beam, which simultaneously also excites the base, so that when they meet aggregations similar to those constructed in the Swiss experiments are created. This method works quite fast: In one minute it was possible to apply 0.7 nanometers of chromium onto a relatively large surface of 0.4 by 1 millimeter with a laser in the spectral range of 425 nanometers.

For the moment the method permits only application of straight line structures. But the developers are working on being able to produce more complex structures as well. This method has the advantage that it is no longer necessary to work with many steps of lithographic masking processes and considerably more expensive x-ray or ultraviolet light. In the subsequent work one will also use two or more laser beams in order to apply structures from not just one but several materials.

At the moment, the still unsatisfactory stability and relatively uneven speed of the laser beams has turned out to represent a bottleneck. It is believed that this problem can be satisfactorily solved in about two to three years. It would then be possible to produce structures with widths of six nanometers. In this way "nanoelectronic" switches could then actually be produced which are about 100 times smaller than today's microelectronic switches.

Meanwhile, applications have been made for several patents for the laser method. The government institute cannot use these patents itself and therefore wants even now to conclude utilization agreements with interested industrial enterprises which are prepared to participate financially and with manpower in the future development work, reports NIST (National Institute of Science and Technology, Gaithersburg, Maryland 20899, USA).

UK: Polymer, Indium-Tin Oxide Electrodes Improve LEDs

94WS0156C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 13 Dec 93 p 10

[Article by OEL: "Brightness of Light-Emitting Diodes Clearly Improved; Polymer in Conjunction With Indium-Tin Oxide Electrodes; Thin Polyphenyl Vinyl Coating"]

[Text] Frankfurt—Light-emitting diodes (LEDs) are based on the phenomenon of electroluminescence—if several electrons with different energy levels come together, they emit photons. The number of photons released is responsible for the luminosity of the LEDs and that depends on the material used.

In addition to the up to now most frequently used semiconductor materials, since 1990, with a discovery by British physicists and chemists at the University of Cambridge, we have also been aware of organic polymer compounds that are capable of electroluminescence. Up to now, however, they exhibited conversion rates of only from 0.5 to 1 percent, corresponding to 200 or 100 electrons per photon released, which is why they did not give off enough light for practical applications.

A polymer now being used by researchers consists of cyanoterephthalyliden, a terephthalic acid used as a substitute, the manufacture of which is well mastered. It makes it possible to produce LEDs with a conversion rate of up to 4 percent. This results in a very high luminosity given the fact that ordinary electric light bulbs attain rates of only about 10 percent.

The new polymer works in conjunction with indium-tin oxide electrodes that are coated with a thin layer of polyphenyl vinyls (PPV). It absorbs into its conduction band electrons that are injected from the electrode material and the coating.

PPV was the first polymer that the team of scientists discovered. But it exhibits a relatively high electron-conduction band and it could only be made luminescent with a very reactive electrode material like calcium. This is why its practical application was not possible. But, since it attaches itself readily to more stable indium-tin oxide electrodes, this makes possible an effective transfer of electrodes to the polycyanoterephthalyliden.

The developers hope to be able to produce bright displays covering large surfaces and, later, computer monitor screens as well with this new and, in comparison with semiconductor materials, easier to process polymer. This is why they have founded a new company, Cambridge Display Technology, Ltd., for its commercial application. This company is expected to obtain additional capital to work out the production techniques, set up possible production, or assign licenses to interested industrial companies. The scientists want to continue their search for more, similar organic compounds and, in addition, attempt to further increase the power output by improving the coating between the electrodes and the active polymer. For further information: University of Cambridge, Cavendish Laboratory, CambridgeCBS OHE, United Kingdom.

Germany: High-Speed Pulsed Laser Microscope Developed

94WS0170B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 21 Dec 93 p 8

[Text] Pulsed laser beams can be used in many ways for material processing. The effects on the material induced by a laser pulse are produced in a very short period of time and in small areas. Exact knowledge about these effects is important for optimal laser utilization. However, there are two goals in observation. First, the observation procedure must possess high magnification. It should also possess high temporal resolution in order to be able to represent the effects of individual laser pulses. Professor Oleg Bostanjoglo and his colleagues from the Optical Institute of the Berlin Technical University (Strasse des 17. Juni 135, 10623 Berlin) have now developed a high-speed electron microscope (EM) linked with a pulsed laser which possesses the necessary properties. The device makes it possible to depict precisely laser-induced crystallization and vaporization processes. According to Bostanjoglo, large effects can be produced in small target areas by irradiating material with pulsed lasers. The high heating and cooling rates lead to the formation of new phases and structures in the irradiated materials which are not attainable using other methods. The technical utilization of the laser is only in its infancy, but has already led to important applications. These include the boring of very small holes, the labeling of components, the hardening of metal surfaces and employment in digital optical read/write memory. Until now the electron microscope has been of only limited use in the investigation of microscopic effects, since while it is sensitive to structure and possesses high resolution spatially, in conventional use it possesses only low temporal resolution. The Berlin scientists have thus converted a commercial electron microscope into a high-speed apparatus.In principle, rapid-exposure photographs can be made in two ways. In continuous operation the sample is constantly irradiated by the electron beam, that is both during and after the laser bombardment. With the help of a scintillator-storage-oscilloscope combination as a detector the individual phases can then be observed with high temporal resolution. The second possibility is that of producing rapid-exposurejphotographs of laser processing with the help of an image enhancer. These photographs are produced by pulses either from the source of illumination or from the image enhancer.In order to investigate the direct effect of the laser beam on the sample, a Nd:YAG laser is combined with the high-speed EM. The laser*beam pulse is focused on the sample in the EM by a laser objective and a deflecting mirror which has a hole for the electron beam. The laser beam and the electron beam run in parallel in the same direction and thus make it possible to investigate the laser effects in real time in a controlled way. The Berlin high-speed electron microscope makes it possible to take rapid-exposure photographs with illumination times from five nanoseconds. The interval between pictures is between 30 nanoseconds and a few microseconds. Both reflective EM investigations of massive materials and transmission EM observations of thin layers can be carried out. The individual pictures can be combined into a "film" in order to observe the dynamics of laser-induced material transformation. Investigations with the high-speed EM have thus far been directed towards research on crystallization processes in semiconductors, structural changes in metals during laser processing, and laser-induced vaporization of thin layers. These researchers aim to achieve a better understanding of laser processing procedures like removal, alloyage, recrystallization, grain

formation and vitrification. The projects are being supported by the German Research Association.

Germany: New Laser System to Check Chips On-Line

94WS0171B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 29 Dec 93 p 8

[Article by GMN: "Laser Monitor for Checking Coating Thickness; New Laser Systems Monitor Coating Processes On-Line"]

[Text] Frankfurt—New kinds of laser sensors that can be used to inspect materials in particular are currently being developed in the Department of Metrology of the University of Saarland. As Prof. Alexander W. Koch explained, surface structures, component movements, surface rough spots, and vibrations, as well as coating thicknesses and optical constants of thin surface films, for example, can be analyzed with these sensors.

Especially the thin coating technique is playing an increasingly more important role in environmental and medical technology in particular. There is a large number of possible coatings that endow the underlying materials with new properties. Laser measurement techniques have also proven to be very well suited to the examination of optically transparent coatings. With them the laser light on the interface between the surrounding medium and the coating is in part reflected and in part refracted into the coating.

The light fractions interfere with one another, dependent on the changes in the optical path. He further said that, since the difference between the optical paths can only be vaired by a change in coating thickness when the material properties are constant, they have with this technique a sensitive in-situ monitor for the thickness of the coating. The resolution maximally amounts to somewhat more than 10 nanometers.

When two interferometers are combined in a dual-beam experiment, their beam paths form different angles with the surface of the coating. If the coating is thicker, there are different periodicities of both monitor signals. Both interferometers detect the difference between the optical paths with high local resolution at the same point on the coating.

A comparison of both monitor signals also further provides, in addition to the thickness of the coating, the refractive index of the coating. Furthermore, Koch explained, computer simulations of the signal sequences allow for conclusions as to absorption coefficients and the homogeneity of the coating.

France Produces High-Energy Aggregate-Ion Beams

94WS0193C Paris AFP SCIENCES in French 30 Dec 93 pp 7, 8

[Unattributed article: "High-Energy Aggregate-Ion Beams Obtained at IPN [Nuclear Physics Institute]"]

[Text] Paris—Aggregate beams consisting of three to four high-energy electrically-charged atoms were obtained recently by an IPN team at Orsay. These results, according to the IN2P3 (National Institute of Nuclear and Particle Physics of the CNRS [National Center for Scientific Research]), "give France a definite lead in this field."

Using a gold source and the Tandem electrostatic accelerator, the IPN team headed by Serge Della Negra succeeded in producing aggregate beams consisting of three to four atoms, each carrying one positive charge (Au^{+++} and Au^{++++} aggregate ions) and having an energy of 10 million electronvolts [MeV].

Aggregates are assemblies of weakly-bonded atoms (from just a few to a few hundreds) that constitute a special state of matter, the structure and behavior are somewhat similar to those of atomic nuclei. Their chemical reactivity and selectivity make them useful intermediates in catalysis, optics, and electronics. Thus, since the eighties, many laboratories throughout the world have been studying them.

More particularly, aggregates are increasingly considered as a replacement for single-atom ions, to bombard solids. Increasing the projectile mass also increases the energy deposited on the bombarded area. Bombarding small areas (of the order of 100 square angstroms) with single-atom ions would require currents of several megaamperes, but it can be done with heavy polyatomic ions (heavier than iron).

The idea of producing at the IPN aggregate beams with energies of several MeV was formed several years ago; two years ago, it became possible to start the project (Orion-Tandem project) with financial support from the IN2P3, the CNRS and the DRET (Directorate of Research and Technical Studies) of the DGA (General Delegation for Weapons).

The method used at the IPN consists in placing a source of metallic aggregates and its beam-directing line at the center of the accelerator and subjecting them to a 10 megavolt potential. The positive aggregate ions thus created and pre-accelerated to 60 kV are injected onto the accelerator axis and further accelerated to 10 MeV per charge.

At the start, researchers faced two questions: Would the aggregates withstand the acceleration, and collisions with the residual gas during acceleration until they reached the experimental site, 20 meters farther? Experiments performed last year with carbon molecular ions (C60 and C70 fullerenes) made it possible to answer this

question in the affirmative. Apart from that, would the electronic setup withstand the 10-15 MeV breakdowns that may occur within the accelerator? That is the problem that the IPN solved in November.

These experiments also enabled the researchers to observe very important non-linear effects (coherent effects much higher than the sum of the effects of individual constituents) and to observe the transmission of shock waves in matter to a distance of 0.2 micron and over. They are currently studying the alterations of the solid after impact.

According to researchers, these results open new prospects: "Energies of the order of one gigaelectronvolts could be reached with other sources, multicharged molecular ions (with masses of 100,000 and 100 positive charges) for instance, and transferred under a very small volume during a single collision and in 10^{-13} seconds."

MICROELECTRONICS

French Tape Automated Bonding Technology, Manufacture Reviewed

BR0303120094 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 10 Feb 94 p26

[Report signed L.M.: "TAB Adapted for Use in Small Batch Production"]

[Text] Are electronic systems manufacturers interested in the development in France of a TAB (Tape Automated Bonding) process for assembling bare chips onto tape? Asked in a survey that could lead to the creation of a company within two years, this question again seems reasonable given the launch of the market in multichip modules (MCM's) which consist of several very complex bare chips assembled onto the same substrate (for use in military, aeronautical, computing, and telecommunication applications).

Chips on Tape More Reliable

Chips mounted on tape can be tested before they are assembled in the module and thus, even in short production runs, present a considerable financial advantage over bare chips connected by wires or beads (flip-chips) whose faults can only be detected after assembly. According to certain experts, tests on modules containing the most complex chips can result in a reject rate of up to 30 percent. For complex MCM's, assembling the chips onto tape also has the advantage of reducing the limitations placed on the connection pitch by the wire method (currently used for most applications) and without seriously affecting the chip design. Karel Kurzweil, in charge of microassembly technologies at Bull, explains: "The dimples for the connection of the chips on the tape are in the same locations as the pins for wire soldering, whereas bead connection over the whole area of the chip means that designers have to redefine the entire mounting process." Until now, and despite these advantages, the manufacturers of sophisticated electronic systems have snubbed TAB technology. Tape-mounted chips require expertise in a large number of manufacturing processes (tape preparation, putting the dimples on the wafers, mounting the chips on the tape, and assembling the TAB chips on the substrate) and thus require large scale manufacture to amortize all the machinery needed. The difference between the requirements of potential users and the requirements of TAB technology therefore dissuaded many outfitters. It is probable, on the other hand, that the creation of a more flexible structure, such as that envisaged by the general arms directorate [DGA], which would handle the assembly of chips on tape at a reasonable cost even for small and medium production runs, would interest MCM manufacturers.

The participants in the DGA's project know that the cost of the service proposed will be the decisive factor. Mr. Kurzweil, the Bull representative in the DGA project, said: "In the TAB process, the large number of tools needed to produce the tape is one of the drawbacks of the technology for short production runs. You should reckon on between 30,000 to 80,000 French francs-worth [Fr] of equipment for each production series." However, he assured us: "We are currently trying to reduce these costs."

Will Euro-TAB Packaging Become a Reality?

Dassault Electronique and Bull have been commissioned by the DGA's electronics and computing technical department [STEI] to study the contribution that could be made by TAB technology to military electronic systems. The two microelectronics specialists, assisted by other partners in the fields of silicon and tape, will have to produce prototypes to prove the economic viability of this type of component. At the same time, the STEI has surveyed potential users (military and civil) to determine what their future requirements in terms of TAB components will be. The results of the survey will be published in the second quarter of this year. According to Roland Even, manager of the STEI project, between Fr5 million and Fr10 million will be invested in these studies. If the results of these evaluations and the survey are favorable, an industrial structure, christened Euro TAB packaging could be created within two years. It will specialize in the supply of tape bonded chips to civil and military outfitters for small and medium-term production runs. The structure will in particular take charge of tape design and control, the production of the dimpling on the silicon wafers, the assembly of the chips on the tape, and their testing and burn-in. Systems manufacturers will then be responsible for assembling the chips onto the substrate. Roland Even was reluctant to disclose precise details of how this potential company will be structured financially, but he said that it will accept production runs ranging from just a few chips to several thousand, and will initially employ several dozen people.

France: Rapid Prototyping of Digital Signal Processing Chips

BR0303120394 Paris ELECTRONIQUE INTERNATIONAL HEBDO in French 10 Feb 94 p24

[Report signed S.D.: "Rapid ASIC Prototyping for Signal Processing"]

[Text] Automatic tools for generating hardware and software prototypes for the emulation of specific circuits—in other words, "virtual" ASIC's [Application Specific Integrated Circuit]—are a relatively recent invention. Quickturn Systems and PiE Design Systems which have now joined forces under the name Quickturn Design Systems, have led the way in this field. The British company Inca (purchased last year by Zycad) has turned the spotlight on digital signal processing applications. Last year at the American DAC show it presented the initial results of its work in the development of systems based on digital signal processors (DSP's) carried out in the context of the European ESPRIT project (footnote 1) (The Retides project. Other participants include Philips, Thomson, EDC/Mentor Graphics, and the Catholic University of Louvain). Continuing with this line of work, Zycad is now bringing to market a family of solutions for the rapid prototyping of specific applications, christened Paradigm RP. The first model in this family is aimed at DSP-based designs. This solution therefore makes it possible to test complex designs based on DSP's even before they are implanted onto silicon. These designs have a degree of complexity ranging from 30,000 to 120,000 gates or more and clock speeds in excess of 10 MHz (usually from eight to 15 MHz, although 20 MHz may be possible in some cases).

Emulation Based on FPGA's [Fixed Programmable Gate Arrays]

The Paradigm RP consists of a software component and a hardware component. The software component is used to draw, partition, compile, check, and debug a logical circuit on a predefined and modular programmable hardware architecture. This hardware component is built around an emulation mother board containing the equivalent of 30,000 gates in the form of Xilinx 4010-type programmable gate arrays. Interchangeable daughter boards can be connected to the main module, enabling combinations of FPGA's, RAM, ROM, DSP's, and DSP cores and forming a part of the emulated system. The company says that it will support a range of daughter boards to cover all of the most common DSP applications.

Zycad is banking on this product to quickly take shares in this rapidly expanding market for DSP applications, more precisely in a segment of the DSP market that the American consultancy Forward Concepts calls FASIC (Function and Algorithm Specific IC) and estimated to be worth $1.2 billion in 1994 and $3 billion by 1997. In addition, Zycad specializes in logical simulation accelerators, fault simulation, and VHDL [Very High Description Language] simulation.

Germany: Miniaturized Electric Engine Developed in Mainz

MI2001151194 Bonn DIE WELT in German 6 Jan 94 p 7

[Article by Franz Frisch: "6,000 Rpm in a Grain of Rice: A 2-mm Motor Goes Into Series Production—Leading-Edge Technology from Mainz"]

[Text] The engine has been running continuously for weeks as a fatigue test, its rotor making 6,000 revolutions per minute. What is so special about it is that it has a diameter of only 2 mm, the size of a grain of rice. It is to be launched in 1994 as the world's first electric motor manufactured using modern microengineering techniques to come onto the market.

Silicon chips first fired information technology, and now miniaturization is also moving into conventional fields such as mechanical and electrical engineering and metrology.

Contrary to what has happened in microelectronics, Europe still has its nose out in front in this technology of the future, which makes it possible to produce a vast range of microscopic components. Over the last 15 years, its inventor, Professor Wolfgang Ehrfeld, has been granted about 50 patents for what is known as the LIGA (standing, in German, for lithography, electroplating, and molding) process.

The first micromechanical motor thus comes not from Boston or Tokyo, but from Mainz, where Ehrfeld set up the Institute of Microengineering (IMM), a 120-strong research corporation sponsored by the Land of Rhineland-Palatinate, in 1991.

Like semiconductor chip circuits, these mini-components are first designed in large scale then projected onto the material in an extremely reduced scale. The three-dimensional structures formed by exposure to parallel x-rays, which are now available worldwide in synchrotron centers (such as DESY [German Electron Synchrotron] in Hamburg).

Simple micromechanical products are already in industrial use: Ehrfeld, who first worked at the Karlsruhe Nuclear Research Center, began setting up the microengineering division at the STEAG AG group in 1988. In 1990, this division turned into the Dortmund company, Micro-Parts, which now has 60 employees and exports microtechnology—to Japan as well. Outstanding examples are its perfectly formed nozzles with diameters ranging from 20 to 100 micrometers for inkjet printers.

The IMM in Mainz goes for more complex applications ranging from a plug for optical communication systems that is only 1 centimeter wide, is easily inserted, and accurately connects 12 ultrathin glass fibers on 1 micrometer, to a device the size of a cigarette packet for measuring thin films on chips. Electronic circuits can even be conjured onto mini-components made of silicon.

The demand for microtechnology solutions, which are on average 100 times smaller than their conventional counterparts, is showing a marked increase: Joint projects with industry in Mainz rose from 11 to 45 in 1993 alone.

Over the three years of the IMM's life to date, Ehrfeld has consolidated its leading position. For example, he has managed to raise the surface quality of ceramic microstructures 100-fold (previous roughness: 3 micrometers, compared with Ehrfeld's current 30 nanometers). Gold-coated diamond membranes give unprecedented precision for x-ray masks—the negatives for lithography. Jena-based Jenoptik GmbH and the IMM have jointly developed an automated machine for producing LIGA structures, the first two models of which have been sold to France and the United States.

As the head of the IMM is aware that the technological lead that it has acquired over the United States and the Far East can only be maintained if research and development reach critical mass, he has established a European network of firms and research institutes in 12 European countries. The EU [European Union] has awarded this joint project a grant of approximately 3.5 million German marks.

Germany: Siemens Develops Ultrahigh-Speed Chips

MI1901122794 Leinfelden-Echterdingen COMPUTER ZEITUNG in German 9 Dec 93 p 21

[Excerpt] [Passage omitted] Alfred Felder and his colleagues have developed a fast chip that breaks the microelectronics sound barrier: Their silicon chip, which measures less than a square millimeter, can process 40 billion bits per second, the quantity of data that would be generated if each of the million-plus inhabitants of a city the size of Munich were to make phone calls simultaneously. The Siemens researchers have set a world record with their 40 Gigabit-per-second microchip: It had previously been considered impossible for a silicon-based circuit to reach processing speeds of this magnitude, with the result that many manufacturers had turned to gallium arsenide, which is costlier and more complicated to work with. Three different processes, applied to the best advantage, brought about this success: transistor technology, circuit design, and metrology. The latest production methods give controlled deposition of extremely thin films precisely where required. Single-crystal semiconductor and insulating films 1 billionth of a millimeter thick can be accurately positioned using this process, which goes hand in hand with transistor technology developments that create high-performance, purpose-structured transistors by depositing microscopically thin semiconductor materials. The transistor technology is complemented by an optimized circuit: "We did not have to reinvent the wheel by any means, as the circuitry principles are not new, but we succeeded in scaling and arranging the components in such a way as to achieve maximum performance," says Felder.

The scientist, who received the 20,000-German mark Philipp Reis Prize for his work, took advantage of his know-how as a qualified high-frequency engineer when developing his high-speed circuit technology. "There are technical sound barriers that you have to know. Once you exceed speeds of a few Gigahertz, the structural and measuring techniques have a major impact," he explains.

The chip is still a prototype and is only a part of the complete 40-Gigabit transmission system. Felder and his colleagues are continuing work on the other key electronic components required for data rates of this magnitude. These include circuits capable of converting parallel data stream inputs into a serial data stream. These "multiplex circuits" are a must for feeding large volumes of data into a glass fiber cable.

There are already trial glass fiber network lines capable of transmitting 10 billion bits per second. The expansion of these networks renders high-performance circuits in the switching stations indispensable. The Siemens researchers expect an early breakthrough for ultra-high-speed transmission technology, particularly in data systems and communications.

This means that future circuits and integrated network concepts will have to handle billions of bits per second if they are to be able to transmit this data together—for high-definition television, digital radio, and mobile phones, for instance.

Germany: Eastern Companies Bring Products to Market

94WS0121C Berlin INGENIEUR DIGEST: WIRTSCHAFT & UNTERNEHMEN in German Nov 93 p 34

[Article by USC] [[

[Text] **Invigorated from Crisis**

Electronics specialists from East Germany appear at the PRODUCTRONICA Exhibition with renewed self-esteem. While two years ago they needed only one common display booth, there are now already 15 exhibitors in Munich.

"It required a great effort to gain a foothold on the market" explains marketing manager Ingo Reichel. A little luck played its role too: In 1991, just during the confusion in the aftermath of the turning-point events, the West European manufacturer of GaAs single crystals Wacker closed shop.

This did not help the people in Saxony much at first, their enterprise still being held in trust. "Had we been so far advanced then as we are today, we certainly would have been able to take over the customers by following target-oriented marketing procedures" assesses Reichel. As it was, however, the competition in Southeast Asia

snatched the customers away from us with lightning speed. "Today we must spare no effort to win these customers back."

At the PRODUCTRONICA Exhibition the Elektonikwerkstoffe (Electronic Materials) Ltd in Freiberg displays single-crystal silicon blocks and slices for photovoltaic cells and electronic devices, also GaAs slices for microwave components and for low-power components. This enterprise has developed and made specialty materials for over the past 35 years. As always, in keeping up with developments in electronics, these materials today are silicon and gallium arsenide.

Also Lothar Spaeth of Jenoptik Ltd is now in Munich. Evolving from the former Carl Zeiss combine in Jena, this company could have afforded to send a representative to the previous 1991 PRODUCTRONICA Exhibition already. Spaeth wants to enter not only the European market but also the U.S.A. and Southeast Asia. With a staff of 1,250 highly qualified employees, the enterprise is active in many business areas: microelectronics, sensors, heavy-duty optics, and precision mechanics.

One strength of Jenoptik is development and production of equipment for the semiconductor industry: electron-beam lighting apparatus, wafer steppers, fine-structure forming apparatus for printed-circuit boards and handling systems, also for measuring and inspection devices.

The Jena people are exhibiting in Munich three innovative developments. The DirectPrint 40 is a laser-type direct-lighting apparatus for printed-circuit boards. It facilitates formation of fine structures having an only 40 µm track width on a printed-circuit board. A minifacility for fabrication under Class 1 clean-room conditions is hidden behind the SMIF Lean Robot SLR 150 AF exhibit. The third novelty is the DefectFinder 2000, a wafer inspecting device with which slicing processes can be automatically monitored.

Now, for the first time, the FHR Anlagenbau (Equipment Construction) enterprise, in existence since 1991, represented in the very traditional Apparatus Construction Post Dresden. This enterprise evolved from the Elektromat enterprise. The staff brought with it many years of experience in development and construction of equipment for vacuum and film deposition processes. With this asset, it should be possible to increase the net output from 1.2 million DM in 1992 to 2 million DM in this year already.

The enterprise does not only develop equipment and devices but also takes over services from and handles products of prominent European manufactures. Its current principal area of activity is environment-friendly treatment, modification, and cleaning of surfaces by plasma and vacuum processes. A large-surface sputtering apparatus makes it possible to coat most diverse target surfaces of all materials currently in use. A whole selection will be shown in Munich.

The Feutron Ltd in Greiz (Vogtland in Thuringia), for over 50 years a specialist in refrigeration, climate, and environment simulation engineering, has already installed about 15,000 climatic test chambers all over Europe. It holds 50 relevant patents. This company will demonstrate in Munich how it reacted to the collapse of ancestral eastern markets by modernizing and shaping up its product line so that now its specialties are: custom-built high-tech equipment for simulation of characteristics of the environment, complete transportable climatic test laboratories, and outdoor measuring stations.

Germany: IBM-Siemens Collaboration to Produce 64 Mbit Chip

94WS0121B Berlin INGENIEUR DIGEST: WIRTSCHAFT & UNTERNEHMEN in German Nov 93 pp 29-31

[Article by Ulrike Scholz]

[Text] **SUCCESS WITH INNOVATIONS**

A message of top significance almost drowned in the general lamentation about the future of Germany's industrial status: At the end of September 1993 IBM and Siemens exhibited their first working samples of the first in the world 64 Mbit chip! Other German companies are exhibiting alongside Siemens: only by way of innovations in the "high-tech" technologies can the crisis be overcome with invigoration. Several items in the area of electronics manufacture which demonstrate this are displayed at the 9-13 Nov 1993 PRODUCTRONICA Exhibition in Munich, but is this enough?

Since 1990 have Siemens and IBM been working in expectation of this day. As to the public response to their success, managers and developers have indeed been more than disappointed. Hardly anyone seemed to take notice when at the end of September the first in the world 64 Mbit chip was shown. The newspaper BERLINER ZEITUNG found this event to be worthy of only three full lines in the WIRTSCHAFT (Economy) Section.

Some samples had already been previously distributed among select customers. The size of a single chip is 10.7x18.1 mm^2. The finest DRAM (Dynamic Random-Access Memory) structures, only 0.35 µm wide, had been produced by the photolithographic process in far-ultraviolet light.

Because of the most readily achievable symmetric and regular DRAM structure, production of this type of memory is so important to a semiconductor manufacturer that methods of producing ever finer such structures are being explored and developed for such memories. This type of memory is, in effect, the stimulator of technological innovations in microelectronics.

With this chip, a German enterprise has finally knocked the Japanese and the North Americans hard in the key

technology dominated by them. What the significance of this success will be in the long run remains to be seen. Meanwhile, a 256 Mbit chip is already being worked on by Siemens together with IBM and Toshiba.

This example indicates that there are some German enterprises which do not participate in general wailing about the recession but rather channel their strengths toward a leading position in the field of electronics. They are pursuing their chances particularly in specialty sectors of the market.

In electronics processing technology and production facilities, strongly emphasized at the PRODUCTRONICA, overseas competition is certainly still ahead. But even overseas innovations have helped German enterprises find a few niches. An example is the new LA 440 S sputtering apparatus, a joint development by the Von Ardenne Anlagentechnik (Equipment Engineering) Ltd in Dresden and the Balzers Hochvakuum (High Vacuum) Ltd in Wiesbaden. This apparatus facilitates deposition of thin films on wafers. It can be easily re-equipped to suit most diverse technological processes and sputtering methods, which is ideal for research and development. It demonstrates a high potential for electronics and machine manufacture in West and East Germany.

Another example is the Karl Kuess Ltd in Garching, worldwide leader in manufacture of x-ray stepper drives. They are used for x-ray lithography, a method of most highly integrated microchip structurization. This company has found a market in the U.S.A., since hardly any x-ray lithography is being done in Europe.

Recently Jenoptik is competing with its x-ray lithographic equipment against Karl Kuess in that overseas market. Its new X-Ray Scanner has attracted worldwide attention of professionals in this field.

Germany is also strong in communications engineering: Siemens, still the world master of innovations, has cropped a winner with its ATM (Asynchron Transfer Modus). This is a multiplexing and exchange system for the future broad-band telephone network. While synthesizing and standardizing this system, Siemens has simultaneously developed the now classical technology based on use of ASIC's (Amorphous-Silicon Integrated Circuits); just as it did for the GSM mobile radio system and for the cordless telephone in the DECT Standard.

New developments are budding even in East Germany, where the electronic industry sector quickly collapsed after having been previously subsidized while cut off from the international market. A scientific and technical potential is still to be found here: LSI Logik in Erfurt, VLSI Technologie in Dresden, Elektronikwerkstoffe (Electronic Materials) Ltd in Freiberg, Jenoptik in Jena, and many smaller candidates for niche positions in the market are vying for them.

In Soemmerda (Thuringia), where once the Robotron combine was manufacturing office machines, Germany's most modern computer factory is now in place and production has resumed beginning last October. In this new plant the ASI Computer Ltd will employ about 600 workers and produce at least 300,000 personal computers annually, which will make this enterprise Europe's largest PC producer. By manufacturing them in Germany, management hopes to respond faster to a fluctuating market demand and to thus extract pricing advantages better than is possible with imports from the Far East.

Take the Electronic Materials Ltd in Freiberg, the sole manufacturer of GaAs single crystals in Europe. After the West German previous manufacturer Wacker had closed shop, the Freiberg company was able to take over its European customers despite a few initial difficulties.

However, top-notch German electronic specialists are rather an exception: "There are no white elephants among the electronic companies" deplores Tom Sommerlatte. At the end of last October the Arthur D. Little consulting team had concluded its investigation of German companies. The objective was to identify those which had in the past three years, despite crisis and recession, realized above average output and profit gains. The list includes quite a few well managed medium-size industries, but no electronic companies.

By the way, Sommerlatte has nothing particularly good to say about the German economy anyhow. The enterprises, he claims, are far too frozen into their old business molds and originate very little innovation.

The Federal Republic is a land deficient in raw materials, which the Research Minister Paul Krueger is quite aware of. Therefore, it can retain its position as a leading industrial country only by top performance technologically and not being last in the field of electronics. Its only chance is investment in intelligence and creativity.

Jens Uwe Fuhrmann of the Bavarian VDMA [Verein fuer Deutschen Maschinenbau und Anlagenbau = German Machinery and Equipment Construction Society] agrees with the Research Minister on this point. But on the foreground of PRODUCTRONICA '93 he has also accused the intolerable power wrangle in Bonn of being responsible for the fact that future-oriented decisions made regarding Germany's research and industrial status are exceptions rather than the rule.

"Discussion about the status, though certainly needed, are missing the main point" believes Dr. Ekkehard Suess, chairman of the Productronic technical group within the VDMA. He demands more recognition for technical science, because it is the source of prosperity and jobs. "It is even helpful in protecting the environment" he said when addressing the PRODUCTRONICA '93 in Munich.

In the long run, Doctor Suess warns, "Germany will not be able to keep up with the international competition if chip production is left more or less to the Siemens company alone." For this key product line competition

in Japan, Korea, Taiwan, and now also in China is being backed by the "entire government machinery." Poor Germany!

Industrial manager Suess calls it outright pure nonsense that ensuring and promoting microelectronics production be entrusted to the Ministry of Research, already burdened by shortage of funds, instead of also involving the Ministry of Economy. As far as the Research Minister Paul Krueger is concerned, Ekkerhard Suess crashes open doors. The minister wants to focus his policy on "the new technologies which have good chances both economically and technically" so that the results of research can be faster converted into competitive products and processes. A top product line under consideration for the next ten years is electronics.

In order to push this through, Paul Krueger had formed a strategizing team which held its first meeting last September. Its task is to set in motion the needed dialog between scientists, economists, and politicians. Members of this team include Hubert Markl (former president of the German Research Society), Ernst-Ludwig Winnacker (director of the GenCenter), Heinrich von Pierer (on Siemens board of director), Edzard Reuter (on the Daimler-Benz board of directors), and Lothar Spaeth (business manager of Jenoptik). Krueger's model is Japan's innovation model. Eventually he will also bring about a general consensus in Germany.

The BMFT (Federal Ministry of Research and Technology) has just pushed through a project involving effective division of tasks between the Government and economic management, namely promotion of the Laser 2000 concept. As a part of this project there have been set up and are being tracked five sub-projects, with diverse objectives ranging from heavy-duty diode lasers to medical instruments.

France: Microsensors To Regulate Chlorine

94WS0116E Paris L'USINE NOUVELLE in French 4 Nov 93 p 65

[Article by Anne Lombard: "Chlorine Regulated At the Faucet"]

[Text] *The Lyonnaise des Eaux [water company of Lyon] and SAGEP [water company of Paris] are validating the first installation of electrochemical microsensors—amperometric cells costing less than 10 francs[Fr] each—to regulate the chlorine in potable water.*

Since chlorine must be used to purify potable water, sensors are needed to verify that the chlorine content is neither too high nor too low. The question is at one and the same time a legal one (0.1 mg/l of admissible residual chlorine), one of prevention (kill the bacteria without poisoning the drinker), and one of comfort (ugh! the horrible taste of javel water!). The answer? Regulate the dosage continuously and in real time. Drawn by the technology of chemical microsensors, Sagep, Lyonnaise des Eaux, and Parisienne des Eaux, have recently achieved the first chlorine amperometric microsensor for use in water. Apic Systeme, another subsidiary of the Lyonnaise company, together with Cylergie, a GIE [economic interest group] subsidiary of the Lyonnaise des Eaux, and the Swiss Microsens company, developed the measurement operating software. The project required three engineer-years and an investment of Fr1 million a year over a period of two years. Several pilot installations, each equipped with some 15 sensors, are undergoing validation in Paris and in the regions.

Enhanced Reliability

Manufactured as an electronics component, hence mass-produced, each amperometric cell will cost around 10 francs. At this price, it will be feasible to multiply the number of cells and to effect measurements on a continuous scale, in real time (the response time of the sensor is less than a minute), and with reliability enhanced by multiplying the number of measurement points. By means of these tiny throw-away chips (they are 1.5 mm thick, 4 mm wide, and have a life of six months), the chlorine will be regulated... at the consumer's faucet! By way of comparison, the macrosensors used, one at the output of a water treatment plant, and one at the input to the distribution network, cost Fr60,000 each. They require bimonthly maintenance. The microsensor requires none. The Lyonnaise company will market the method both by sale of the cell to other water companies, and in the form of a "pen" for spot-testing samples. The company is conducting research in the direction of bacteriological detection.

France: Metal-Base Printed Circuit Developed

94WS0172D Paris L'USINE NOUVELLE in French 2 Dec 93 p 68

[Article by Thierry Lucas: "From the Cire group: Printed Circuits that Diffuse Heat"—first paragraph is L'USINE NOUVELLE introduction]

[Text] A new metal-base substrate quite suitable for power electronics is currently being tested at Peugeot. It could also be used in telecommunications. Multiplexing considerably simplifies the electric wiring of vehicles, but it requires the development of very specific technologies. In particular, the printed circuit—the substrate of electronic component interconnections—must possess three qualities: good dissipation of the heat produced by power components, small overall dimensions, and both at an affordable price. The SMI (insulated metallic substrate) developed jointly with Peugeot by BREE (a subsidiary of the Cire group) meets these criteria. A preseries designed for use on 1,000 XM vehicles is being manufactured; it will be used to test the new process on a quasi-industrial scale.

The most original feature of SMI printed circuits is that they use a metallic base instead of the standard glass-epoxy material. Actually, the circuit is built on an aluminum foil no more than 3 mm thick, which is

covered with an insulating layer on which the copper conducting plate is pressed. Additional conducting layers can be obtained by using silver or copper-based polymer pastes. When the circuit is equipped with its components and mounted in the car, therefore, the heat it produces can diffuse into the metallic substrate and from there into the car body. This is an efficient solution that does not require adding a heat sink on the circuit—the usual method to improve heat dissipation in power circuits. According to Pascal Poisson, the BREE manager, the savings achieved by not having to purchase and install these heat sinks should offset the additional cost of the metallic substrate, so that the cost of the product would be about the same as that of a traditional circuit.

Industrializing the SMI process required the development of adequate production means. In particular, since aluminum foil is a malleable material it cannot be machined with the equipment traditionally used in making printed circuits. The metallic plates must therefore be drilled, cut, and scribed with special tools developed by BREE.

The conveying and loading/unloading systems were also modified to accommodate the new substrate, which is heavier than traditional substrates.

A total of 1 million francs was invested in preseries production facilities. The Peugeot group's certification of the insulated metallic substrate already created considerable interest from other potential clients (in telecommunications). They are waiting for the first results of the full-scale test performed on the 1,000 XM vehicles which, according to BREE, might warrant going on to mass production.

Expanding European Market for Chip Cards Seen

94WS0139A Duesseldorf WIRTSCHAFTSWOCHE in German 3 Dec 93 pp 96-99

[Article by Burkhard Bondel: "New Pillar"]

[Text]

Electronics

Europe's Semiconductor Industry is Finally Holding a Trump Card: The Chip Card.

"I'm going to buy some bread," calls the five-year-old to his mother on Saturday morning. She replies, "OK, but don't forget the chip card." Benjamin routinely pays the baker with the card.

"Where did you last see a doctor?" asks the physician in Munich. He is talking to the tourist from Hamburg who is having heart trouble. Instead of answering, the patient inserts the medical insurance record chip card into the physician's computer, releases the data stored in the chip using his personal identification number, and allows the doctor to read the patient's history.

"Please insert your chip card," requests the screen of the new arrival. Only after comparing the typed code with the code stored on the chip card does the computer network become enabled for the user.

Paying, storing, unlocking. The variety of applications of the plastic card is virtually inexhaustible thanks to the integrated chip that may contain a complete minicomputer. The handy medium is opening completely new possibilities of drumming up customers primarily for the service branch. "The present applications are just scratching the surface," says Hans-Dietrich Kreft He is the managing director of Angewandte Digital Elektronik (ADE) from Dassendorf in North Germany. Kreft is one of the most committed trail blazers of the chip-card technology. The untiring promoter was among the winners in 1987 of the innovation prize of the German economy. Today, he can be certain that the chip card is conquering the world with mass applications.

The Europeans, in particular the French and Germans, are the front runners. They have an important advantage, "the larger domestic market," says Winfried Gaal. He is the product manager at Giesecke & Devrient (G&D), a chip-card manufacturer in Munich.

After successfully introducing the phonecard, the Germans are now reaching for the chip twice with the medical-insurance chip card and a new Euroscheck [check guarantee] chip card. While the electronic substitute for the medical insurance record card will be introduced starting on the first of January 1994, the new 'ec' chip card will presumably be available in 1995, according to information from the banking branch. About 120 million chip cards will be necessary just for these two applications.

The European electronics industry, which has not exactly been spoiled, is the beneficiary. "The chip card can become a new pillar for the European semiconductor industry," predicts Ulrich Hamann. He is the director of marketing for chip-card ICs at Siemens AG.

Besides Motorola as the only non-European, just Siemens, Bull, SGS-Thomson and Philips possess the necessary know-how and fabrication capacities at this time. Due to this, the ranking of vendors is unusual for electronics conditions. With 30 per cent of the market, both Siemens and Motorola are running neck and neck, followed by SGS-Thomson and Philips. Hitachi appears in fifth place as the first Japanese chip manufacturer. It has a skimpy six per cent of the market. The Europeans have fallen by the wayside in the triad competition. However, they may be able to experience another success story with the chip card similar to that for the GSM standard for cellular telephones. This has proven to be an export hit.

In any case, the timing of the market introduction is perfect. The insurance card does not appear to make sense at first glance because the potential of the chip is not fully exploited. Only the data present on the medical insurance record card are stored. The physician prints

out a standardized form with these data and continues to handwrite his services on this form. However, this is just what the semiconductor manufacturers want. On the one hand, "Using these relatively simple chips, we can learn how to stabilize our production process," according to the Siemens expert Hamann. On the other hand, the corresponding readers and physician's computers will create an infrastructure that will subsequently enable the use of more demanding chip cards.

Consequently, the big bang in the card industry is set. Market surveys by Siemens claim that the world market for the chips the size of a finger nail will grow from 160 million marks last year to almost 1,000 million marks in 1997. Of this amount, the German chip manufacturer wants half. Axel Hartstang is the managing director of the German subsidiary of Motorola. He expects that sales of less than 50 million cards currently will grow almost ten times to more than 400 million within five years.

In this respect, the chips are only a fraction of the business. They must be integrated into the card and personalized for the individual user by special service providers. For image reasons, marketing strategies allow the plastic substrate to accept high-quality printing. In addition, the system operates only with readers.

With the domestic market and technical lead, the Europeans have the best chance of dominating the world market over the long term. Card producers such as G&D, Orga Kartensysteme, Oldenburg, Gemplus and Schlumberger are already supplying their products to the burgeoning markets in Australia, Brazil, South Africa and Hong Kong. Success is beckoning Siemens even into the lion's den. The conglomerate from Munich is on the verge of completing deals with Dai Nippon Printing and Toppan, two of the largest printing firms in the world. The company from Munich is to supply chips to Japan. The chips will be installed in cards there.

The Europeans have also been working flat out on chips that offer processors and complex operating systems (so-called controllers). Courageously, they are now defying Motorola, the vendor previously dominant in this sector. These open systems form the prerequisite for so-called multifunctional cards. Such cards allow not only one special application but can even be equipped with new functions later.

Consequently, according to the plans of the Central Credit Committee (ZKA), the owners of the new 'ec' cards will not just be able to withdraw cash from automatic teller machines and make telephone calls. These cards will also function as electronic wallets. To allow for the transfer of small amount such as paying for bread, the chips are loaded with specific sums which can be paid out little by little. For larger amounts, a credit line is stored on the card. Even the primitive medical insurance chip card will be extended to a comprehensive patient card over the long term. Then, it will store data regarding accidents and portions of the medical history in addition to management specifications.

Such multifunctional cards could also work as tickets for buses and trains. While buying the correct ticket at an automat is more of a game of chance today—primarily in strange cities—the electronics does everything for the user of the chip card. "Because of this, we are hoping to reduce the inhibition threshold and get more customers to use public transportation," says Achim Muller. He is the managing director and consultant for the cities of Luneburg and Oldenburg.

Without having to study any sort of schedule, the rider inserts his card into a reader when entering and exiting. The central computer can then not only determine the cheapest fare. Frequent riders also get a discount. In Luneburg, no rider pays more within 30 days than the price of a monthly ticket.

IBM-Siemens-Toshiba Cooperation to Develop 256-Megabit DRAM Chip

94WS0171C Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 29 Dec 93 p 8

[Article by TAR: "DRAM Chip With Trench Cells"]

[Text] Frankfurt—IBM, Siemens, and Toshiba want to use a trench-cell structure in developing their common 256-megabit DRAM memory chip. This structure was recently presented on the occasion of the International Electron Devices meeting of experts in this field in Washington. What is involved is a self-aligned trench-circuit contact which is defined by the intersection of a deep trench-memory node and the "shallow" trench insulation. As described in the journal SEMICONDUCTOR INTERNATIONAL (Vol. 16, 1993, No. 12, p 18), the trench cell, a "buried" strip, is 0.55 x 1.1 micrometers in size. It is produced with the aid of the 0.25-micrometer technique. The cell surface is claimed to be only 0.1 of a square micrometer larger than the theoretical minimal surface of such a cell and the smallest of the folded bit-circuit cells that have been proposed. It differs considerably from Mitsubishi's planar-stacked capacitor-cell design, which was also reported on at the Washington conference. The superdielectric, constant barium-strontium-titanate film was also discussed.

NUCLEAR R&D

CERN Director Proposes Thorium-Based Reactor

94WS0153D Paris AFP SCIENCES in French 25 Nov 93 p 16

[Article: "Revolutionary Nuclear Reactor Proposed by CERN Director"]

[Text] Geneva—Nuclear generating plants powered by an inexhaustible energy source that is also virtually

risk-free and poses no military proliferation threat: This is the revolutionary project unveiled on 24 November in Geneva to some 500 physicists from all over the world by Professor Carlo Rubbia, director of the European Particle Physics Laboratory (CERN).

Speaking in CERN's crowded amphitheater, the Nobel Prize-winning physicist explained that ecological concerns had motivated his conception of this project, which builds on earlier work and consists essentially of an "energy amplifier" driven by a heat-producing particle accelerator. In other words, the project consists of "extracting energy from heavy nuclei with the help of nuclear cascades induced by an accelerator." One might even go so far as to envision an "upsurge in global demand for nuclear energy to replace fossil fuels" such as hydrocarbons that engender so-called "greenhouse gases" and contribute to warming of the earth's atmosphere.

According to Mr. Rubbia, the particle amplifier, which would use thorium (abundantly available) rather than uranium as fuel, represents a safer solution because the reactor would be "subcritical" and there would be no danger of chain reaction.

Mr. Rubbia noted the general public's misgivings about traditional nuclear reactors in light of accidents such as Three Mile Island and Chernobyl and the need to bury highly radioactive waste products for very long periods of time. Use of thorium in this way would offer the advantages of "being simple, safe, cleaner, not posing any important technological hurdles, nonproliferating, and inexhaustible," Professor Rubbia said. Small plants would produce virtually no plutonium, and "no one could make a bomb with it." But Professor Rubbia concluded on a warning note: The project is still at the stage of "virtual reality, and experimental verification will be required," along with very complex calculations, before the idea is implemented.

According to CERN spokesman Neil Calder, Mr. Rubbia has computer-tested his theory and plans to begin experimental work on it next year at CERN. Most of the physicists reacted positively to the proposal, Mr. Calder said.

In his presentation, the Nobel Prize-winner said his work was based on research done in the 1950s by W. Lewis (Canada) and more recently by Professor C. Bowman's team at Los Alamos (New Mexico). At the end of December, Mr. Rubbia will step down as director of CERN, which he has headed for the last 5 years, and will be replaced by Christopher Llewellyn Smith. He will then devote himself entirely to his energy project.

CERN Considers Final Hadron Collider Proposal

94WS0174D Paris AFP SCIENCES in French 23 Dec 93 p 11

[Unattributed article: "LHC [Large Hadron Collider] Project Presented to CERN Council"]

[Text] Geneva—On 17 December, the board of the CERN [Nuclear Studies and Research Center] (the European Particle Physics Laboratory), which includes representatives of its 19 member states, reviewed the final version (technical parameters and budget) of the LHC (Large Hadron Collider) project which, if built, will be the most powerful particle physics facility in the world.

According to Professor Christopher Llewellyn Smith (Great-Britain), who will succeed Professor Carlo Rubbia as CERN director on 1 January 1994, the cost of this giant proton-proton collider, which will be 10 times more powerful than the CERN's present electron-positron ring, the LEP (Large Electron-Positron Collider), is estimated at 2.23 billion Swiss francs (nearly 9 billion French francs [Fr]).

If it is approved by the board during the first half of 1994 (the decision should be made in April), construction of the LHC might start in 1995 and be completed in 2002. The expenditures concerning the project were included in the CERN 10-year plan for 1995-2005. Pr. Llewellyn Smith said that member states might increase their participation and mentioned the possibility of both intellectual and financial contributions from nonmembers, such as the United States now that the SSC [Superconducting Super-Collider] project has been abandoned, which "complicates the decision."

In fact, a few weeks ago, the U.S. Congress refused to go on with the construction of the SSC—a project similar to the LHC but still more gigantic and powerful—which was deemed too costly (total cost: about $11 billion). People in Geneva estimate that, as a result, "thousands of physicists, in particular U.S. physicists, will be tempted to come and work at the CERN" if the LHC is built.

France is in favor of building the collider, which will be set up above the LEP, in the 27-km-diameter ring under the French-Swiss border. Early in November, Russia expressed its intention to contribute to the construction. In addition, Switzerland recently announced that it would grant the CERN a loan of 34.4 million Swiss francs ($23 million) for the construction of a new building that might provide an additional 876 work stations.

Every year, 6,000 scientists from all over the world (including already an increasing number of Americans) come to the CERN, which has a permanent staff of 3,000. For over 10 years now, the CERN has been the leading particle physics laboratory in the world. Building the LHC would enable it to retain its rank and to make new discoveries, several of which have already been predicted by theoreticians, for instance that of Higgs' boson.

The CERN board also approved the laboratory's 1994 budget, which amounts to 924.1 million Swiss francs, compared with 951.67 million Swiss francs in 1993.

Karlsruhe Nuclear Center Opens New Tritium Laboratory

94WS0143B Duesseldorf HANDELSBLATT in German 2 Dec 93 p 14

[Article by "nl" under the rubric "Research and Technology": "Karlsruhe Tritium Laboratory/Laboratory Studying the Fuel for an Energy Source for the Distant Future/Settling of Safety Problems. Fusion Research Has Supplanted the Fast Breeder"; first paragraph is an introduction]

[Text] Duesseldorf, Wednesday, 1 Dec 93 (HANDELSBLATT)—Now a tritium laboratory (TLK) has officially opened at the Karlsruhe Nuclear Research Center. This is an experimentation facility by means of which nuclear researchers want to acquire precise information and working know-how in dealing with larger quantities of tritium—a necessary step toward the hoped-for commercial exploitation of nuclear fusion for the generation of electricity in the still distant future.

The acquisition of reliability and safety data have to have high priority here. Tritium, the heaviest of the three isotopes of hydrogen, along with deuterium (heavy hydrogen) is needed as fuel for plasma fusion reactors. Nuclear fusion—the fusion of light atomic nuclei and the atomic-energy-liberation process of the sun—is at some time to be utilized in fusion reactors on the earth for energy transformation and the generation of electricity. Therefore, TLK's specified tasks are dictated by the requirements of research and development work on fusion research. The nuclear research center is included with the fusion project in the European fusion technology program and in the ITER (International Thermonuclear Experimental Reactor) reactor project.

With TLK the nuclear researchers in Karlsruhe have the first finished experimentation facility of this size for fusion research in Europe. As yet they have seen comparable facilities only in Los Alamos, USA and Tokaimura, Japan. The laboratory was built over a period of seven years with an investment of around 45 million German marks [DM]. The state of Baden-Württemberg and the Federal Ministry for Research and Technology each absorbed in a special financing arrangement 50 percent of the costs incurred. The Nukem and Siemens companies were appointed as general engineers by the nuclear research center for construction of the laboratory.

The laboratory was built in the same building in which a breeder test stand was built in the seventies. This demonstrates the change in KfK's [Karlsruhe Nuclear Research Center's] scientific-technical problem range and the reconstruction of its infrastructure and experimentation facilities. Working with the lightest elements, the isotopes of hydrogen, is being practiced today in the same room in which years ago heavy elements like uranium and plutonium were dealt with.

Radioactive tritium has a (relatively short) half-life of 12.3 years, but at the same time high diffusibility through other materials. The researchers want to achieve the safe handling of this hydrogen gas by means of a multiple barrier system. This consists of the metal walls of the equipment and pipes in which the gas is handled. In addition, all the apparatus is enclosed by a secondary system with glove boxes, a sub-atmospheric-pressure maintenance system, and tritium hold-up.

Development Work for Protection of Personnel and the Environment

The building itself constitutes the third barrier. Its exhaust air is constantly monitored. Not only will the feasibility in principle of the occurrence on just the earth of the fusion process that takes place in the sun be decided one day by the realization of this process in a reactor, but also the solution of as yet less discussed safety problems in the protection of personnel and the environment.

As a priority, chemical and process engineering problems relating to cleaning the fusion reactor fuel mixture will be worked on within TLK's range of tasks—like, for example, the removal of impurities such as oxygen and nitrogen. Uranium, which combines tritium in the form of uranium tritide (a stable uranium-hydrogen compound) acts as a storage medium. The tritium can be set free again by heating up this storage medium, and the tritium is then available for experiments. An integrated isotope separation system can separate the components of hydrogen mixtures into normal hydrogen (H), deuterium (D) and tritium (T) and resupply the thus purified tritium to the experiments. The pilot plant's process control system is automated and permits round-the-clock operation.

Germany: Encapsulated Ge-Detector Developed for Euroball Project

94WS0156B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 10 Dec 93 p 8

[Article by SEL: "Encapsulated Ge-Detector"]

[Text] Aachen/Juelich—An encapsulated Ge-detector has been developed by the Juelich research center (KFA [Nuclear Research Facility]) in collaboration with the University of Cologne's Institute for Nuclear Physics and the Intertechnique company in Strasbourg. The ultrahigh-vacuumtight, encapsulated germanium detector was brought to production readiness in the main Department of Technology within the framework of the Euroball project. The so-called Euroball is a gamma spectrometer that is being developed through European cooperation and will be used for experiments in the field of high-precision gamma spectroscopy. With it exotic nuclei of borderline stability can be studied.

In addition to greater reliability, the advantages of the Ge-detector are protection of the extremely sensitive surface of the detector as well as ease of operation and interchangeability. Furthermore, it is possible to join

Ge-detectors together into complex detector arrangements of any kind whatsoever. These detectors can be regenerated without any problems when there is radiation damage by heating them up in standard ovens.

The range of applications of Ge-detectors includes gamma spectroscopy for the identification of exotic atomic nuclei, applied research, protection against radiation and of the environment, and applications in the field of medicine. Furthermore, the Ge-detectors presented by the KFA nuclear physics institute in Juelich in the journal "Inside KFA" (No. 3) can be used in industrial production control and space.

In connection with technology transfer, the Juelich research center has concluded a licensing agreement for the production of encapsulated Ge-detectors with Intertechnique. A patent for the production process has been applied for at the German Patent Office. This year a total of 16 detectors were produced and delivered.

France: Experimental Nuclear Accident Attempted

94WS0167A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 6 Dec 93 p 10

[Article: "Nuclear Accident as Experiment"]

[Text] Marseilles/Paris (DPA/AP)—At the nuclear research center in Cadarache near Marseilles they are trying to deliberately bring about a meltdown of the sort that occurs during a presumed major accident in a power plant. The researchers hope to gain clues from this experiment as to how to improve the safety standards for future nuclear reactors. The experimental plant in Cadarache was provided with additional safety equipment to prevent radioactivity from escaping from it. Moreover, the experimental reactor contained only a small fraction of the amount of fuel in reactors of the customary size. That is why critics of the experiment have doubts as to whether the results obtained here in the laboratory can be applied to the conditions in large nuclear power plants. There were contradictory statements with regard to the duration of the experiment, which might also indicate that the experiment could have been prematurely terminated on Thursday of last week. It further means that the results of the experiment will be reported on in the course of this week. The institute wants to undertake five more experiments of this kind over the next few years.

Germany: Subsidies for Innovation, Research Called For

94WS0167B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 16 Dec 93 p 8

[Article by TN: "Subsidies for Innovations and Research Personnel; Federal Aid for Research for New Federal States: A Ministry of Economy Survey"]

[Text] Frankfurt—The federal government's economic aid measures in the new federal states are extensive. These aid measures are described on 230 pages in the minister of economy's new brochure (BMWi [Ministry of Economy]: "Economic Aid in the New Federal States," 53107 Bonn, Public Relations Department). The currently relevant aid measures for research in the new federal states should be represented below. Applications and detailed information may be requested from the addresses given. At the present time the most important measures are being supported by the Ministry of Economy and the Ministry for Research and Technology (BMFT). They can be summarized as follows:

1. Aid for innovations: Aid is provided for projects for the development of innovative products by legally independent firms with less than 1,000 employees of the industry that produces them in the new federal states. The conditions are: 35 to 40 percent of the costs of the development project per firm, with a maximum of DM800,000. Address requests for advice on applying for aid to: Aid for Innovations, Establishment of Technology-Oriented Companies, VDI [Association of German Engineers]/VDE [Association of German Electrical Engineers] Technology Center for Information Technology, Budapester Strasse 40, 10787 Berlin. Telephone: 030/264890; fax: 030/26489141.

2. Research staff in small companies (BMWi): a maximum of DM240,000 a year per company with its head office in the new federal states and less than 1,000 employees. Applications and information available from AIF (Working Association of Industrial Research Associations), Berlin. For existing increases in research personnel, commissioned research, and cooperation on research: AIF, Berlin Branch Office, Tschaikowskistrasse 49, 13156 Berlin. Telephone: 030/4826649; fax: 030/4824366.

3. Aid for increases in research personnel (BMFT): Firms with up to 1,000 employees may receive up to DM250,000 a year for an increase in research staff. Applications through AIF, Berlin.

4. Industrial association research: It is only supported for AIF member associations.

5. Commissioned research in two forms for companies in the new federal states. Applications through AIF, Berlin: Contributions of 50 percent, but not more than DM300,000 per company with less than 1,000 employees and with its head office in the new federal states and commissioned research farmed out.

   Contributions to contractors of commissioned research in the new federal states in the amount of 40 percent of the total costs thatqualify for contributions, provided that these institutes or companies have less than 250 employees.

6. Aid for the establishment of technology-oriented companies: Individuals who want to found a technology-oriented industrial enterprise and companies that have been operating in this field for no more than two years may receive up to DM1.8 million. Applications through VDI/VDE, Berlin.

7. Loans for research: Research loans are granted throughout Germany and can be applied for through the local bank. Companies with a sales volume of up to DM50 million can obtain a total loan of up to DM3 million at a current interest rate of 5.75 percent a year and a term of 10 years. The loan is paid off through the Credit Bank for Redevelopment, which manages BMFT funds for this purpose. For research loans: the local bank, which rediscounts the loan through the Credit Bank for Redevelopment.

8. Furthermore, until 1997 there will still be a research bonus (a specific indirect subsidy) amounting to DM600,ooo per company throughout Germany for the application of biotechnological methods. Applications and information: Juelich Nuclear Research Center, Biology Project Sponsor, P.O. Box 1913, 52425 Juelich, telephone: 02461/613171. For research bonuses in biotechnology: Juelich Nuclear Research Center; Biology, Energy, and Ecology (BEO) Project Sponsor, telephone: 02461/613171.

9. Joint research in the economic sector: The BMFT grants up to DM600,000 per company for joint research between at least two companies in Germany that have no more than 500 employees. Applications and information available from AIF.

Germany: Juelich Reactor Uses Cross-Flow Technique in Simulation

94WS0167D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Dec 93 p 8

[Article by JB: "Juelich Reactor Operates With Biomass Support; Activated Sludge Tank Simulated; Separately Ordered Filtration Uses Cross-Flow Technique"]

[Text] Juelich—Bacteria perform important tasks in sewage plant activated sludge tanks. They break down a multitude of undesirable compounds like ammonium and highly ecologically harmful, problem-creating substances. Simulation of the growth processes in these tanks is necessary in order to study the decomposition processes. Wolfgang Tappe of Juelich Research Center, Ltd., (Institute for Biotechnology [IBT3], 52425 Juelich) has now developed a bioreactor system that is suitable for these tasks.

As Tappe informed us in Juelich, bacteria grow in the soil and in water, as well as at sewage plants, at very low rates of growth. The supply of nutrients is frequently so limited that it is only enough for bacteria to survive, but not sufficient for growth. The study of these processes is important in view of the services bacteria render in breaking down harmful substances. With conventional bioreactor systems, however, simulation of these kinds of growth conditions is impossible or only very limited. With a continously operating laboratory bioreactor, a specific amount of fresh nutrient solution per time unit is supplied and the corresponding amount of consumed medium removed. In the process, biomass is also lost, which has to be replaced by the growth of the bacteria in the reactor. Now if the organisms' maximal rate of growth is very low, the danger exists that the lost biomass can no longer be replaced.

Since the average generation periods at activated sludge plants range from 150 to 500 hours, they are comparatively long. In simulating these growth conditions, conventional bioreactor systems are frequently overtaxed. Since the nutrient supply in this case is only very little, an even distribution is in part no longer attained in the reactor. The result is that the bacteria population is no longer homogeneous. Some bacteria grow faster than others.

The solution to the problem lies in the Juelich reactor with biomass support. The principal difference between it and the conventional, continuously operating reactor is a separately ordered filtration module. In it the consumed medium is filtered out while the bacteria are held back. The filtraiton process is not simple since the round filter has a tendency to get blocked. Tappe has solved this problem with the cross-flow technique. A magnetic agitator that creates a flow that moves at right angles to the direction of filtration (cross-flow) rotates right above the membrane. With this system, blockages can be successfully prevented.

The molecule is surrounded by a high-grade steel housing and is connected with the reactor container by hoses and pumps. In this way a continous supply of nutrients can be obtained without any loss of biomass and bacteria with very low rates of growth can be studied. These growth conditions come very close to the actual conditions in activated sludge tanks. The Juelich system's filtration module can also be used for on-line monitoring of sewage plants. It delivers a biomass-free sample from which chemical parameters can be determined.

European Nuclear Waste Storage-Related Issues Analyzed

Paris LE MONDE in French 12 Jan 94 p 12

[Article by Jean-Francois Augereau: "Nuclear Waste: Worldwide Problem"]

[Excerpts] Installation of Storage sites Is Posing Problems Everywhere in the World

Where should waste from nuclear projects be stored? How can it be done under conditions acceptable to all? The issue is so sensitive and the public is now so watchful and cautious that the governments of nuclear energy producing countries think twice before presenting their proposals. Ten years ago, who would have predicted the proliferation of mediators, sent to the front

lines by public administrations, nuclear industry manufacturers, and brand-new agencies in charge of managing this waste, to inform, reassure, answer questions, and consider everyone's probing and apprehension before reaching any decisions?

Nuclear power can no longer be forcefully imposed; public administrations have understood this and have learned their lessons from the past. In February 1990 the Rocard government, aware of difficulties it would encounter if it imposed this or that site for storage of highly active waste from the nuclear industry, chose to halt hostilities with the determined population on 9 February 1990 and to let time do its work. Of course this decision was not completely devoid of electoral considerations, but excessive coercion eventually creates a trap which Rocard wanted to avoid by declaring a one year moratorium on the management of these awkward waste products.

The 30 December 1991 law on this issue has formed a legislative framework for any new steps in this regard and given mediator Christian Bataille the heavy responsibility of consulting constituencies and collecting voluntary proposals from communities interested in the installation of an underground laboratory for research on nuclear waste. This was a good initiative and about 30 such proposals came quickly to light.

Today, four departments, Gard, Haute-Marne, Neuse, and Vienne have been tentatively selected by Bataille (see LE MONDE of 6 January) and the government has just authorized the Radioactive Waste Management Agency (ANDRA) to begin geophysical surveys of the sites. Here again, cautiously, the authorities will take their time for one to two years before reaching any decision.

Groundbreaking for the laboratories, which will cost 1.5 billion francs each, cannot begin before the end of 1997 at the earliest, which means that operations would begin in 2002. This would be followed by eight years of research on site quality (nature of bedrock, water flow study, deeply-imbedded materials performance, and so on); this is because ANDRA is not scheduling materials storage before 2020 at sites that have yet to be determined assuming the program is authorized to continue after Parliament deliberations around 2010.

This surfeit of caution is not unique to the French authorities: all nuclear energy producing countries are facing the same type of problems. As a matter of fact, France is managing fairly well at present with its surface storage for low radioactivity waste at the Hague (Manche) which is filled, and at Soulaines (Aube) which has just opened. The only remaining problem is to, so to speak, settle the delicate issue of permanent storage of highly active waste. One step has just been taken with Bataille's report. Many other countries wish that they were that far along.

Strong Local Opposition

In Europe the situation has more facets as a few examples will illustrate. In Germany where disagreement is sharp, it is clear that all nuclear industry waste will be stored underground regardless of its radioactive level. Storage has already been established at two locations for low and medium-activity radioactive waste: at the former salt mines in Morsleben near the old East German border, and at Asse (Lower Saxony). The latter has in fact been for some years, the site of international experiments for storage of high radioactivity waste.

Two other sites also in Lower Saxony are currently being discussed as possible storage centers. The first is in Gorleben where two wells are being drilled in a salt dome for high radioactivity waste, the first shipments of which may come in 1994 and 1999 from France and Great-Britain. But work on this project has been stopped. The second is at the Konrad iron mine for less radioactive material. But its placement into service is being hotly contested between the federal government and the Lower Saxony authorities.

In Switzerland where there a research laboratory in granite already exists at Grimsel, nuclear industry waste is housed on-site at plants and research facilities, while waste resulting from other industry activity has been temporarily stored since 25 November 1992 at a 9.3 million Swiss franc installation in Wurenlingen in the Argovie canton. For permanent storage, the Cooperative for Radioactive Waste Storage (CEDRA) approved in June of last year a center whose cost is estimated at 500 million francs and which would be built in Wellenberg in the semi-canton of Nidwald.

Swedish Example

But canton authorities are blocking current construction based on their recently acquired legal power to grant licenses for underground utilization. Many discussions must yet take place before Parliament issues a decision (in 1997?) on this proposed center whose operation could begin in 2005. As for high radioactivity waste, this is only the beginning.

Preliminary drilling intended to analyze the nature of the soil (granite and gneiss) has already been conducted in the northern part of the country in Bottstein, Leuggern, Weiach, Kaisten, Schaffisheim and Siblingen. Other drilling operations have been requested by federal authorities to prospect clay deposits in the Aar Valley and in the area between Baden and Schaffhouse. But as the JOURNAL DE GENEVE pointed out last summer, in Siblingen, the canton authorization procedure for drilling took six years while at the federal level it took one year and eight months. "All that time to come to the realization that the site was not suitable..."

Clearly waste management is not an easy matter and according to nuclear energy promoters it is hampered less by technical difficulties than by social and political problems. The country currently having the most success

in resolving them is Sweden, whose early decision against reprocessing irradiated fuels at its plants has made the choices easier.

Sweden has an underground facility, the SFR, carved out of granite on the Baltic coast not far from the Forstmark plant, which since April 1988 has been used for permanent storage of low and medium radioactivity waste. At the same time the Stockholm government in the early 1980's commissioned an enormous underground storage center in Oskarshamm, the CLAB, intended for storing irradiated fuels from Swedish plants for 40 years before they are permanently buried in the substrata of the country's two northern communes situated right in Lappland near Arjeplog and Overkalix (see LE MONDE 17 September 1992).

Discussions are underway to determine which of these two locations may receive these vexatious ashes. There is no hurry, even if it takes time to win over a very skeptical public opinion. This is why, in spite of CLAB's intermediate storage (CLAB received its first highly radioactive shipments in July 1985), the Swedes want proof "through a dress rehearsal" that their permanent storage plan in granite is efficient.

The Swedish Fuel and Radioactive Waste Processing Company (SKB) has thus begun drilling a deep tunnel in granite at Orskarshamm near CLAB; this is the Aspo Hard Rock Laboratory (HRL) which is intended to serve as proving grounds for the engineers. The whole facility should be completed at the end of 1994 or the beginning of 1995. But unlike its Canadian counterpart, URL at Pinawa in Manitoba, this underground laboratory will not be converted to a storage site.

SUPERCONDUCTIVITY

UK: Impurity Doping Makes HT Superconductors More Stable

94WS0148A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 1 Dec 93 p 8

[Article by oel: "Impurity Doping Is To Make HT Superconductors Capable of Carrying More Load"]

[Text] Frankfurt—Application of the new high temperature superconductors (HTSL) still fails in many areas because the superconductivity is lost under the influence of comparatively weak magnetic fields. When ceramic materials under the influence of magnetic fields get a little below a Tesla, they are only superconducting at very low temperatures of a few Kelvin. For important practical applications superconductivity under magnetic fields can therefore only be used with metallic superconductors and by cooling with expensive liquid helium.

But physicists of the University of Birmingham (School of Physics, Birmingham B15 2TT, United Kingdom) have now succeeded in making the movement of the magnetic field lines in high temperature superconductors visible. Consequently, there is now an opportunity directly to observe the effect of measures against the drifting of the field lines.

With this discovery the developers of high-temperature superconductors hope to be able to solve the problem in a way similar to the comparable behavior for metallic superconductors: By doping the material, the field lines are "frozen," which makes the construction of high-performance magnets for computer tomography possible, for example.

The observation and image recording of the magnetic field lines in high temperature superconducting materials succeeded with a neutron-scattering method in a bismuth, strontium, calcium-copper oxide high-temperature superconductor. The methods used so far in order to determine the collapse of the magnetic field lines were based on indirect measurement processes which did not give an image.

With the neutron scattering method both the crystalline structure and the field line can be recorded. If the high-temperature superconductors being studied are under the influence of a magnetic field and the temperature is raised from a few degrees Kelvin, after a certain point there will be such large internal resistances that this causes the crystalline structure to be lost.

This has the result that the superconducting state is also abruptly halted. Because of this phenomenon the British physicists speak of a "melting away" of the magnetic flux structure (flux lattice melting). In the high temperature superconductors available today this will already take place at temperatures between four and ten Kelvin.

The continued development work by several research groups in Europe, the United States and Japan is now aimed at finding ways to prevent the "migration" of the magnetic field lines as far as the area of critical temperatures between 90 and 100 Kelvin. With the "old" metallic superconductors this could only be achieved by adding certain compounds. Nevertheless, it took almost 10 years before this doping technique had been mastered from the aspect of production technology. Whether this will be achieved for high-temperature superconductors in a similarly long development process, is something no one dares predict.

Meanwhile, the development work continues in the United States as well. With massive support from the U.S. Department of Energy, the development of efficient current limiters for public grids from high-temperature superconducting materials is to be accelerated.

As reported by the authority, a consortium of three enterprises and a government research laboratory headed by the General Dynamics company (San Diego, California 92186, USA) has been awarded almost 5 million dollars for these development studies.

These funds are to help the company develop operational current limiters in two to at most four years. The authority expects that by using the new type of current limiters energy losses on the order of 100 million dollars a year can be avoided.

Current limiters are relay-type switches which keep the currents in high-voltage grids within certain ranges. They reduce the network current if, for example, lightning strikes or if there are short circuits. They protect the power consumers against having their equipment damaged by excessively high current.

By installing superconducting current limiters in high-voltage networks, relatively simply constructed and cheap power interrupters and simple fuses can be used. The investment and operating costs of the supplying enterprises could thus be reduced and the production of excess power be avoided.

This way the output of the supply networks can take place in certain voltage ranges, which leads to considerable savings for the power supply companies even at relatively modest cost.

The new high temperature superconductors which are being used for this are not under the influence of magnetic fields at the limiter circuits. For that reason, even with the critical currents of high temperature superconductors reached today they can be used without any further difficulties.

Superconducting switching elements have the advantage over conventional current limiters that they regulate the supply currents with very short switching times, practically unnoticed by the consumer, and in this manner provide largely uniform currents.

France: High-Temperature Superconductivity Record

94WS0174C Paris AFP SCIENCES in French 23 Dec 93 pp 9, 10

[Unattributed article: "High-Temperature Superconductors: Dramatic Breakthrough by Two French Teams"]

[Text] Paris—Within a few hours of each other, two teams headed by French scientists announced that they had achieved a dramatic breakthrough in the field of superconductivity, raising it for the first time to around zero degree Celsius, and thus heralding the day when superconductors will be available at room temperature and under normal pressure.

On 17 December, the CNRS [National Center for Scientific Research] announced that researchers at two of its Grenoble laboratories had obtained mercury cuprates that are partially superconductive at temperatures ranging from 190 Kelvin [K] (-63 degrees Celsius [C]) to 280 K (+7 degrees C), thus beating the 250 K (-23 degrees C) record announced less than 24 hours before by a team of the Higher School of Industrial Physics and Chemistry of the City of Paris (ESPCI) headed by Michel Lagues—which record, according to the researchers themselves, remains to be verified.

Although these results were obtained by different methods and with different compounds, nevertheless they prove the existence, long in doubt, of superconductivity at a very high "critical temperature" (below which a material will conduct electric current without opposing any resistance to it). Less than three months ago[1], the record was only 157 K, at a pressure of 235 kilobars (about 235,000 atmospheres), whereas the new results were achieved under normal pressure.

The Grenoble researchers, at the Research Center on Very Low Temperatures (Jean-Louis Tholence, Benedict Souletie, Olivier Laborde) and at the Crystallography Laboratory (Catherine Chaillout, Jean-Jacques Capponi, Massimo Marezio, and Miguel Alario Franco) obtained mercury cuprates, consisting of mercury, barium, calcium, and CuO_2 copper oxide, and more precisely with [sic] the phase Hg-1223 ($HgBa_2Ca_2Cu_3O_{8+d}$), as well as Hg-1245.

What did the team headed by Jean-Louis Tholence and formed nearly seven years ago observe? The two "signatures" of superconductivity: a sudden drop of electric resistance (in seven of the samples) and the "diamagnetic transition," which shows as an apparent magnetization in a direction opposed to that of the magnetic field applied to the sample (on the 15 or so samples), at temperatures ranging from 190 K to 280 K, depending on the compounds.

According to Jean-Louis Tholence, the record, a "superconductive transition" at 280 K, was observed on "one percent of the sample volume." Its structure remains to be determined in order to obtain samples with larger "superconductive" fractions. A report on this research will be published on 3 January in the American review PHYSICS LETTERS.[2]

At the end of September, the Grenoble physicists had already achieved a record, reaching a critical temperature of 157 K in a mercury cuprate (Hg-1223, already), but subjecting the sample to a very high pressure: 235 kilobars. Like Paul Chu and his team at the Houston University, they used the fact that, in these cuprates, bringing atoms closer together (which can be done by applying pressure) will increase the critical temperature.

In November 1992, the Crystallography Laboratory had discovered the first compound of the family, Hg-1201 ($HgBa_2CuO_4$) with the collaboration of Serguei Poutiline of the Lomonossov University in Moscow, who was in Grenoble at the time.

The Grenoble researchers' samples measured about 10 cubic millimeters. The material in which the ESPCI team[3] observed a "resistive transition" at 250 K—i.e. a sudden decrease of electric resistance, "by a factor of 100,000," which led the researchers to believe that it involved a superconductive transition—was a bismuth

cuprate, of the BiSrCaCuO family (bismuth-strontium-calcium-copper oxide), deposited on a substrate in the form of a 30-nanometer thick film. In addition, the characteristics of the phenomenon—in particular its non-linearity, i.e. the anomalies observed in the current/voltage ratio (which normally increase [sic] in a linear manner)—"point to the existence in this material of a superconductive phase at a still higher temperature, which a few minor changes might make evident."

This result, an account of which was published in the American weekly SCIENCE,[4] was obtained through long and persistent research performed in collaboration at the Tel-Aviv University (Guy Deutscher), the Higher Normal School (Philippe Monod, Nicole Bontemps), the Pierre-et-Marie-Curie University (Julien Bok, also at the ESPCI), and the Institute of Materials Sciences and Radiation or ISMRA (Guy Raveau) in Caen.

Actually, back in 1986 a Surfaces and Superconductors team was created at the ESPCI; the following year, the team leader, Michel Lagues (with the support of Jacques Lewiner, scientific director of the ESPCI, and Julien Bok) decided to attempt the development of thin-film superconductors. To deposit these films on a substrate, one atom layer at a time, the ESPCI decided to acquire a machine that Riber, the French manufacturer of epitaxial facilities (which currently supplies 50 percent of the world market) took two years to develop, jointly with the ESPCI team.

Although the initial results were disappointing, which explains why many teams throughout the world became discouraged—actually, in cuprates, atoms are not always willing to cooperate and grow in a single plane (a phenomenon which Michel Lagues proposed to call "infinite phase" growth)—the team managed to master this method of "epitaxy through imposed sequence of atomic layers," which is continuously controlled by electronic diffraction, and they prepared their first sample, with three layers of copper oxide, and then, two years later, the present compound with eight CuO_2 layers.

The technique was covered by a patent application and a structure was set up jointly with Sofinnova for "the industrial implementation of this research." Although the diamagnetism of the sample remains to be verified (a difficult operation considering the thinness of the film, which tests the sensitivity of measuring instruments), the ESPCI seems confident. These results, they estimated, "should open a new field for the study of the superconductive properties of cuprates," and above all "should make it possible to achieve the goal pursued for 15 years by many laboratories throughout the world: to dispense with cryogenics, which until now was required to achieve superconductivity at normal pressure."

With the results of these two teams, the wild hope of obtaining superconductive materials at room temperature therefore seems to be taking shape. Although no "superconductor market" can be envisioned within the next five years, as Michel Lagues pointed out on 17 December, nevertheless huge long-term prospects are opening up in the low-current field, i.e. in electronics and data processing.

Footnotes

1. See AFP SCIENCES, No. 894, 7 October 1993, p. 16.

2. PHYSICS LETTERS, A-104, 3 January 1994.

3. Michel Lagues, Xiao Ming Xie, Hassan Tebbji, Xiang Zhen Xu, Vincent Mairet, Christophe Hatterer, Christian Beuran, Catherine Deville-Cavellin.

4. SCIENCE, Vol. 262, p. 1850, 17 December 1993.

TELECOMMUNICATIONS

Italy: Telecom Italia Companies Presented

MI2401100794 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 32-33

[Text]

Iritel Joint Stock Company

This was created on 8 May 1992 to manage the transitional phase that will lead to the constitution of a single administration. It will guarantee the continuity of services by transferring and retraining personnel who were formerly with ASST [State Telephone Services Agency] and PT [Post and Telecommunications] (about 12,000 people), and by creating the technical, economic, and organizational conditions for the successive integration of its own operational structures into the new system. It is the sole administrator of public and private telecommunications systems (including equipment installation and management), formerly done by ASST and the PT Administration. The telegram, electronic mail, and public telematics services carried out by post offices, national telex-data services and, until the relative concessions expire, those entrusted to SIRM [Italian Marine Radio Corporation] and Telemar, are excluded.

Iritel supplies the means of transmission within the national long-distance network for interconnection between the transit switching nodes of the SIP [Italian State-Owned Telephone Company] (SGT) network and between these and the national transit nodes managed by Iritel itself (for European traffic) and by Italcable (for intercontinental traffic). Furthermore it manages international traffic to and from Europe and the countries bordering on the Mediterranean basin, together with the relative equipment.

Italcable Joint Stock Company

This company manages intercontinental telecommunications services (telephones, data transmission, telex, cables, and new value-added services). Furthermore it participates in the study and realization of the more

important underwater cable systems. It is collaborating with partners in the Atlantic area to build a vast and complex network that directly connects North America, the Mediterranean, and South-East Asia. Its network is one of the largest and most diversified in the world and uses both cables and satellites in a balanced way.

It is quoted on the stock exchange and has a capital stock of 275 billion lire. In 1992, with 3,068 employees, its proceeds were 789 billion lire; investments totalled 120 billion lire with profits of 130 billion lire.

SIP Joint Stock Company

SIP—the Italian telecommunications company that administers national public telecommunications services—is responsible for customer relations. It guarantees the basic telephone service, with 23.7 million subscribers (in 1992) that will rise to 26 million in 1996, with a density of over 45 percent of the population. One subscriber in five belongs to the business world, whilst there are over 1 million mobile telephones and it is forecast that this number will double by 1996. There are more than 240 million kilometers of circuits under our cities and along our motorways and in 1996 about 40 billion communications are forecast, that is more than 75,000 per minute.

The primary goals of SIP are the modernization of the network and the management and maintenance systems, improvement of quality, and the introduction of new services (ISDN [integrated services digital network], intelligent networks, etc.).

It is quoted on the stock exchange and has a capital stock of 5.465 trillion lire. With 89,293 employees, in 1992 its revenues were 21.557 trillion lire; investments totalled 9.718 trillion lire and profits 461 billion lire.

SIRM Joint Stock Company

SIRM is involved in the installation, running, and maintenance of the radio stations that legally must be on board pleasure craft and ships bearing the Italian flag. In addition it sells various types of radio navigation aids. These are divided into two categories: those with a high innovative content for ships with large tonnage (satellite terminals and integrated navigation systems) and those that use the older technologies, for a wider and less professional market, such as the fishing sector and pleasure craft.

It has a national maintenance network with 10 operations depots and about 40 agencies in the principal coastal towns.

Telespazio Joint Stock Company

Telespazio—space telecommunications company—has the exclusive concession in Italy for satellite communications (telephones, television and data). It participates in advanced space programs and in the design and testing of new applications for satellites. It is developing the use of small antennas on dedicated networks and has over 400 completed installations. It is the first supplier in the world of telemetry services, and services for the management and control of satellites in orbit. It receives, processes, and distributes the data transmitted by Earth observation satellites (remote sensing).

It has a capital stock of 40.2 billion lire and has 1,130 employees. In 1992 its revenues were 348 billion lire; investments totalled 126 billion lire and profits 25 billion lire.

European Euro-ISDN Launched Without EU Support

BR2101092694 Bierges ELEDIS JOURNAL in English Dec 93 pp 1-2

[Editorial: "A Question of Competitivity"]

[Text] We are believers in the opportunity market that may be created by ISDN and so it appears are the national telecommunication companies (TELCOs) which shortly, before the end of this year, will begin to celebrate the birth of Euro-ISDN, Europe's ISDN showcase. In its most recent meeting, the European ISDN User Forum, which now boosts an average attendance of some 300 participants—mainly service providers, at its six-monthly rendez-vous, announced TELCOs plans for launching the special EURIE '93 week from 12-17 December.

The demonstrations, to run concurrently in all main European cities, will come to a head on December 14 when, in a live broadcast from Brussels, top European Union (former European Community) executives and Belgacom chairman, Bessel Kok, will discuss ISDN and map out its European future.

In another meeting, recently held at one of Europe's best-known universities, ERASMUS in The Netherlands, we have already tested for ourselves some of the promises of ISDN.

Live videoconferences and all forms of multimedia transmission (what will come of Electronic Trade Data Interchange?) are possible with a modest Apple and a 64 Kbits/s channel. Two channels offer much better quality of course. Cost? Not more than ECU5,000-6,000 (dollars approx.), computer and telecamera included.

But this is only part of the Pandora's box that may be opened up by ISDN. Consider the opportunities for teleshopping, telebanking, interactive television and other multimedia wonders. British Telecom is likely to be allowed to send movies to the homes of all who have a telephone. Analogue may offer patchy quality, but ISDN, through the very substantial advances made in the past two years in data compression technology, will certainly be up to standard.

In the meantime, whilst Europe is struggling to find its ISDN identity, other developed regions are not waiting on the sidelines. East Asia, Pacific countries and North

America are moving swiftly to be ahead of the game. Pacific Bell, one of the large United States "Bell" companies, has just announced plans, in line with the political motivation of Vice-President Gore, for the creation of the "super highways" data infrastructure, modernizing its California network with a fibre cable investment of some ECU16 billion. Forecasts are for some five million homes to be connected by the year 2000. To put this in perspective, that is more than all houses in Belgium.

Europe is also doing what it can, although, if one takes the recent announcement by Mr. Carpentier, Head of the powerful Directorate General XIII (Telecommunications, Information Market and Exploitations of Research), for a ECU90 million grant to help ISDN developments, one begins to wonder what sort of minimalistic policies Europe is beginning to implement. Sure, this is money that will go towards sharpening interconnectivity and convergence, but it is like spraying droplets of water on dry soil. Hopefully this will only be an interim measure, until the EU's Council of Ministers unblocks funding for some ECU13 billion for the next quadrennial plan for research and development in the European Union.

Still, as this money must be shared amongst all sorts of R&D, very little can be expected to be added to the ISDN pot.

It goes without saying that TELCOs prefer to address their investments to their own markets and may consider European needs as peripheral matters. Why release, for the common good, research and development effort that may give other operators a leading edge?

We must consequently accept with some reservations any claim that ISDN is fully available across frontiers. TELCOs' driving strategy may differ and so will the facilities that they provide. Full integration will be delayed by other important factors. Few European TELCOs aim to provide facilities wall to wall, something that would make ISDN really take off. France, the United Kingdom and a good part of united Germany may move perceptibly ahead, but most of the others show more than unwillingness to offer customers ISDN home-based facilities.

We, for one, resident in the capital of Europe, ten minutes by car from the headquarters of the powerful Directorate XIII, Telecommunications, will be unlikely to see the light of fibre optics in our office this century, if ever. Imagine the destiny of some of the more remote regions in this Europe of ours.

Then there is the problem of cooperation. We are all agreed that telecommunications knows no bounds, yet it looks as if the dismantling of those we have today may take sufficient time to ensure that we all become economically handicapped in the meantime. Size is the game of the next century: to have size, one needs alliances. It may be a shame that Europe's three giants (British, French and German TELCOs) did not manage to decide on a common penetration policy and have now gone their separate ways, forming two distinct blocks, one by the British Telecom and MCI alliance and the other codenamed Project Atlantic (French, German Telecoms and AT&T).

It reminds us of efforts, in the late 1970s, to try to bring Euro manufacturers, ICL, Siemens, BULL and Olivetti around the discussion table to form a Euro-venture. See what has become of them now.

Of course, there is always the spectre of Directorate General IV, the Competition Directorate of the European Commission, to remind us that such alliances create almost monopolistic situations. Let's wait and see.

Yes, we are believers of the opportunity market that may be created by Euro-ISDN, but we know that this will only be possible if it is given size, spread and funding to implement killer, multimedia-based applications. In short, a joint investment in hard Euro-cash rather than soft Euro-words at Euro-ISDN festivities.

ISDN Coverage—subscriptions—migration to EURO-ISDN (Status on 01 Jan 93)

	Territorial Coverage		No. of subscriptions		Migration to EURO-ISDN		
	BRA %	PRA %	BRA	PRA	Offering existing ISDN until	Offering EURO ISDN from	Tariffs fixed
Belgium	15	100	821	9	end 1994	1993	1993
Denmark (PTT Telecom)	-	-	-	-	-	-	-
Denmark (Tele Denmark)	100	100	1217	62	only EURO-ISDN	Jan 92	Jan 92
France	-	-	-	-	-	-	-
Germany	-	-	138831	11304	2000	1993	Apr 93
Germany (old Laender)	70	70	-	-	-	-	-
Germany (new Laender)	ded.cities	ded.cities	-	-	-	-	-
Greece	-	-	-	-	-	-	-
Ireland	-	-	-	-	-	-	-
Italy	37	37	1000	20	Nov 93	Nov 93	Nov 93
Luxembourg	-	-	-	-	-	-	-
Netherlands	10	10	400	15	1998	Jun 93	Apr 93
Portugal (TLP)	40	40	5000	250	end 1993	latest end 1993	latest end 1993
Portugal (CPRM)	-	-	-	-	-	-	-
Portugal (CTT)	-	-	-	-	-	-	-
Spain	10	10	150	-	-	-	-
UK (BT)	-	-	-	-	-	-	-
UK (Mercury)	-	-	-	-	-	-	-

Notes: BRA = Basic Rate Access; PRA = Primary Rate Access.

Germany, Ukraine: German, Ukrainian PTT Ministers Agree on Cooperation

MI1901123194 Bonn POST POLITISCHE INFORMATION in German Dec 93 p 5

[Text] The Federal Ministry of Posts and Telecommunications [BMPT] has concluded a memorandum of understanding with the Ukrainian postal administration on aid with legislation on the postal reform planned in the Ukraine. Dr. Laufs handed and illustrated to the Ukrainian delegation a paper on the assistance to be provided by the Federal Government in an advisory capacity. He pronounced the BMPT willing to tutor experts from the Ukraine in Germany. There is enormous interest in the Ukraine in laying and operating optical fiber lines for the trunk network, and a leasing model is being drawn up with DBP [Deutsche Bundespost] Telekom to finance the program. In parallel with the political talks, BMPT manager Masson discussed the issue of radio frequencies with Ukrainian specialists. Their talks covered openness in frequency allocation, licensing, and approval matters, charges, monitoring systems, and organizational and working procedures. Since its separation from Moscow, the Ukraine has had neither specialists nor data material at its disposal. Germany thus promised support with the technical preparations for the forthcoming world broadcasting conference.

The telecommunications sector in the Ukraine is much courted, and the United States, the Netherlands, and France are all trying hard to get a foot in the door for their companies. DBP Telekom, too, has permanent representatives in the Ukraine: Telekom holds shares in mobile radio and the digital overlay network, and has also trained 100 experts from the Ukraine. Siemens maintains a joint venture engaged in manufacturing its EWS [electronic switching system].

Italy: STET Three-Year Investment Plan Presented

MI2401144894 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 35-37

[Text] STET has just celebrated its 60th anniversary and has begun to make its "comeback" by establishing the basis for the development that will take place in the coming years, and that will see it playing a leading role in the most important change in the history of Italian telecommunications. It is an organizational and financial effort that has no precedents and is already being formed as a result of the law providing for the reorganization of telephonic services, the first tangible effects of which will be seen between 1 January and the end of 1996.

The document has still not been made public but some guidelines have been revealed by Managing Director Michele Tedeschi.

In brief, there are plans for an investment program that will have a total value of 32 trillion lire, and a growth in revenues of between 30 and 36 trillion lire per year, with the goal of reaching a telephone density of 48.4 percent in a context that is becoming more and more internationalized. These are the most important statistics of the "group program" for 1994-1996, that was approved in mid-November by the STET board of directors, presided over by Biagio Agnes. This period will be particularly demanding for the IRI [Institute for the Reconstruction of Industry] finance company, because of the reorganization of telephonic services to form a single operator, Telecom Italia, and the effects of this reorganization that will start to be seen within a market situation that is continually evolving both at home and abroad.

The sole operator, which will surmount the fragmentation of the five former concessionaires, will face the opening up of overseas markets following the abolition of the monopolies, the appearance of large foreign corporations, and the formation of new alliances that go beyond national and continental barriers.

The formulation of the plan is therefore coherent with the current trends of demand that accentuate the supremacy of market factors in a context that is increasingly characterized by strong competition. With the new organization, the Italian system, like those of the other major European countries, will be able to present itself on the services market with a structure that is capable of enforcing a strategy of a single offer and competitivity, with the prospect of reaping all the possibilities of growth in the telecommunications sector.

In particular, the constitution of the sole operator, the formation of which, it has been confirmed, will take place before September 1994, will permit its intrinsic synergies to be exploited. Consequently this will strengthen its position both on the national and international markets, and ensure the group a more favorable contractual position within the context of a global alliance.

Specific emphasis will be given in the new plan to client segmentation to be able to prepare the most appropriate response in terms of services/prices, particularly for business clients. The rapid strengthening of the network structure and the relative administration systems, the strong nationwide organization of customer services, and the evolution of the pricing structure, will contribute to this. In 1994, the latter in particular will already have the goal of gradually reducing existing mutual assistance to give greater competitiveness to the global supply system through the reduction of long-distance prices, and thereby start to catch up with the most advanced organizations at international level.

Therefore, in view of the fact that the program contract will be applied when the single operator is formed, the plan has been worked out on the basis of a price restructuring process that does not presuppose greater net capital contributions to the sector. The resulting benefits will be an improved utilization of the network and a more favorable market position.

These actions are part of a management plan that also foresees achieving a notable improvement in economic-financial strength.

Under this profile the program is characterized by a growth in the volume of revenues from the current 30 trillion lire to 38 trillion lire by 1996, and by overall investments of over 32 trillion, and a revenue situation that will be decisively better than that of 1993, the results of which were already favorable. It is also forecast that debts will be notably reduced thanks to the good progress of internal financing which, in the next three years, will be clearly in excess of requirements for investments.

As far as quantitative aspects are concerned the program provides for:

—An increase of about 1.5 million subscribers to the fixed network, 600,000 of which business subscribers; an increase of over 800,000 subscribers to mobile services; a density (subscribers to fixed and mobile services) that will reach a value of 48.4 percent by the end of 1996; and a final total of over 300,000 ISDN [integrated services digital network] equivalent connections;

—A development of national traffic for which a growth rate of 6.7 percent per year is foreseen, and of international and intercontinental traffic for which notably higher increases are foreseen (respectively about 12 percent and over 13 percent);

—Further technological updating of the network, continuing with the digitization of the exchanges (77 percent by the end of 1996) and the extension of optical fibers to the distribution network too. As far as the industrial sector is concerned programs are aimed at improving productivity and increasing foreign market penetration. Special emphasis has been placed on the complete integration of the Finsiel group to exploit the potential synergies of information science and telecommunications services.

Finally, the process of internationalization, which provides for investments of about 1.5 trillion lire, hinges on the acquisition of licenses to carry out services in areas of preeminently strategic interest as well as on the reinforcement of the supply system in an international environment through strategic alliances that also involve the industrial activities of the group.

Italy: Telecom Italia's Future Plans Described

MI2401143794 Turin MEDIA DUEMILA in Italian Dec 93-Jan 94 pp 24-25

[Text] A workforce of 106,000 employees, 11.58 trillion lire in investments, 24.896 trillion lire in revenues from sales: With this identity card the companies involved in the reorganization of telephone services in Italy have faced 1993, the year that has seen them lead separate lives for the last time. In fact, at the end of December, the formal acts required by the Italian civil code for the constitution of the sole telecommunications operator, which will have its new organizational structure by 1994, will be completed.

Even if the new company, Telecom Italia, does not formally exist, the general lines for its development have already been traced out at STET [Turin Telephone Finance Company]. The plan for the next three years is not, as plans in former years have been, a "company" plan. It has been prepared as a "business" plan in view of the current situation. It is a group plan that will identify itself with the new operator plan. It is not the sum of various company plans, but a plan for a new integrated organization. It contains the basic directives and the stages of realization up to 1996.

Italian telecommunications have started to move in two directions in recent months. The first is the legal definition of the form of Telecom Italia, starting 1 January under the convention, and should in any case be finalized by next September. The second will establish the operational structure of the company, with the first three-year plan being constructed "in the laboratory." Though the companies are still separate, STET is busy preparing a plan which is based on the logic of a single organization and not on the simple coordination of autonomous programs.

This first attempt is the premise that will make the single plan operational for the next period: the three years 1995-1997. This will be the real organizational plan for Telecom Italia and will be created using this new logic from the beginning. The strategies are being prepared. Successively they will be verified by the units dealing with the individual products, and then nationally. The feedback will be put together to initiate the process of adaptation to actual market requirements.

To get an idea of the task awaiting the new single operator we should consider the fact that the number of telephone subscribers in our country will increase from 22.35 million in 1990 (with a density of 39.78 percent), to 25.19 million in 1995, and 29.83 million in 2000 with a density of 52.1 percent. According to forecasts, the percentage increase of subscribers over the decade 1991-2000 will touch 33.5 percent. In market terms, a total of ECU92.562 billion is forecast for the decade 1991-2000.

Telecom Italia is being set up to be the sole operator of all the services that are subject to controls at the present time. It is easy to see that when we get to 1998, with the complete liberalization planned by the EEC, the operational structures will have to adapt to the new situation. In fact, the operators for the services to be liberalized will either have structures that are based on existing divisions, or distinct entities will be formed.

The operator could have a structure based on operational divisions for controlled services, and perhaps have independent structures for the services that are not controlled. Telecom Italia will come under the STET holding company, so it will be alongside other companies (software companies, manufacturers, etc.). Relationships with the outside world, the general policy, and coordination will be defined at a holding level to make the maximum use of existing synergies.

The telecommunications world is complex so it is difficult to outline a definitive policy at this moment. For example, mobile radio services, that is small mobile telephones that are available today using structures of superimposed networks interconnected with the fixed network, still remain an open issue. It is necessary to define regulations for interconnection by evaluating both the technical problems and the economic problems (access charges and others).

In any case, with the liberalization planned for the coming years, the operator will be able to offer customers a "package" of services using a single system that is the result of very close integration.

Internationalization

Telecommunications is moving toward a world that has no frontiers. The most recent forecasts indicate that in 1995 more than half a billion of the 5.1 billion inhabitants of the world will be telephone subscribers, with a density of 11.68 percent. At the start of the new century there will be 5.4 billion inhabitants and the subscribers will increase to 723.4 million, this being a density of 13.32 percent. A percentage increase of 44.7 percent is forecast for telephone subscribers during the decade 1991-2000. Furthermore, processes are under way to open up markets for telecommunications services that will provide interesting prospects for the operators. These facts alone show that operators must undertake a process of internationalization aimed at reinforcing overseas markets. There are two roads that can be followed.

The first is tendering for licenses in countries where the system is being privatized. This type of participation would also provide the other members of the group with opportunities. For example, in Argentina, STET, having acquired the telecommunications license for the north of the country, is providing new openings for both manufacturers and for plant installation.

The second road is that of the problem of alliances with foreign organizations. This affects all the group, which operates in all areas of the information technology sector, and has areas of convergence between the operators of services, constructors of equipment, and producers of software. In the United States, a colossus like

AT&T allies itself with various local partners to offer its own services/products on a world basis. In this context the goal of the operator must be to "serve" business clients, and in particular the multinationals, with a new supply capability. That is to say the operator must be capable of satisfying the communications requirements of its clients with technical commercial structures, and with a portfolio of products/services that can satisfy a demand that is becoming more and more personalized, and that as far as geographical dimension is concerned, often goes outside national boundaries. It is a process that will become more and more important in the world of the future and that will cause a major ferment in the new markets. For this reason the sole Italian operator has launched its own policy of internationalization, as the major operators throughout the world are trying to do. It is an obligatory choice in order to face the opening up of the markets, in which the competition tends to acquire the richest parts, given that the market cannot be defended by staying at home.

Telecom Italia, like the other operators, must rapidly insert itself in international alliances where the goal is to protect the world market that will no longer be regional but global at the end of this decade following liberalization.

The choices are:

1) To have local distribution agreements for the services of third parties;

2) To be one of those operating at a global level, constructing services together with other administrations.

The Italian telecommunications system is classified sixth in the world for volume of business. Because of its size and what it can offer, it cannot remain limited to its own country. The Italian operator cannot just be a distributor at a local level. It must enter into alliances with partners who will contribute to increased competitivity at a world level in order to protect its clients at home, to acquire shares in international markets, and to carry out the role of a global operator with an infrastructure, commercial network, and portfolio of products/services that enable it to acquire competitiveness worldwide.

The policy of alliances has been pursued for some time by other countries, and from now on it will be a point of fundamental importance for modern operators. We cannot wait until Telecom Italia is ready with all its structures: for this reason work is already being done so that the new operator can start off with a precise direction for its actions in the international market. The network of alliances should therefore be operative when the new sole operator is officially formed.

An essential point is the choice of partners. It is necessary to choose partners that have common objectives, in order to combine capacities and resources, and to be able to increase presence on the market. The characteristics of individual operators should be taken into consideration when seeking partners to bring complementary activities together, thereby attaining greater competitive strength.

If Italy is to retain its place within the "group of the seven most industrialized countries" the Italian telecommunications system but must be an active, not a subordinate, partner in the new initiatives. It must play a role of equal dignity in the game of alliances that is being defined and must build up relationships with the goal of offering global services: This will start in the first instance with an agreement between operators. Then it will be possible to think about successive agreements with other bodies (for example in the software sector, etc.), to extend the competitivity of the group, utilizing the synergies of an integrated system like STET.

The STET group is looking at the future as a challenge that is presenting itself at a moment that is rich both in opportunities and in threats. The opening up of world markets, and their complete liberalization, are fundamental elements characterizing the new scene in which the operators have to move. The STET group, understanding the size of the problem that has to be faced from an organizational point of view, and the strategic choices that are necessary, has already started to introduce greater efficiency and productivity on the operational structures side and to also acquire greater competitivity for the entire range of its products/services through alliances that can ensure suitable complementarity.

International Affairs: EC Satellite Ruling Set To Rouse U.S. Anger

BR0802093094 Hampshire INTERSPACE in English 21 Jan 94 pp1-3

[Unattributed article: "The EC's Directive on Satellite Communications"]

[Text] The EC has issued its draft directive on the mutual recognition of satellite licenses. The draft directive is aimed at the markets for such activities as provision of FSAT services, MSS services and SNG.

A major change from previous proposals from the EC is the addition of a one stop shopping procedure in the directive, replacing the concept of a single community license issued by the Commission. This reflects what has actually happened at national level over the last two years. Whilst the Commission clearly wants a mechanism which provides licenses that are harmonised and fully recognised by all member states, the transitional one stop shopping procedure reflects the reality that this will be slow and difficult to implement. It also appears to reflect a shift of power away from DG XIII to CEPT and national level.

The Commission hopes that the transitional concept of one stop shopping will be replaced over time by "appropriate harmonisation conditions".

The document is largely silent on the issue of direct access to Eutelsat and Intesat—"As concerns the discussions in the International Satellite Organisations... on improvements to the access conditions to the space segment capacity of their respective intergovernmental

satellite systems, this proposal builds on the progress of these discussions and in particular the recent decision by the Eutelsat Assembly of Parties to propose the Member States options for improved and broadened access either through the installation of a national Signatory Affaire Office and/or through the so called multiple access option in which access to the capacity can also be sought via Signatories other than the national one. The proposal foresees that both options shall be implemented and recognised."

The position is a significant shift from the 1990 Green Paper which explicitly called for EC action to ensure direct access to Eutelsat and Intelsat. However, the EC says that the draft directive now "further builds on the discussions and decisions taking place within the International Satellite Organisations and in particular those within the Eutelsat framework."

An indication of just how slow the Commission has been in this sector is that the Green paper was issued (after much delay) in November 1990. The final directive is planned for implementation no later than 1 October 1995. Trade sources suggest that this is a tight timetable given that European Radiocommunications Office (see later) has other greater priorities than satellite communications; it is unlikely that the Commission will have its act together until well into 1995.

Power to CEPT

The draft directive calls for a major CEPT role in implementing the harmonisation of licensing conditions for satellite services as distinct from the interim one stop shopping set up. CEPT represents all European countries, not just the 12 members of the European Union. The draft calls for two CEPT bodies to have a role, the European Committee for Telecommunications Regulatory Affairs (ECTRA) and the European Radiocommunications Committee/Office (ERC).

"As a first step, ECTRA may be mandated by the Commission to elaborate the technical basis for harmonised licensing conditions, based on the expertise of ECTRA and ERC, in the wider European context, and as such appropriate to satellite communications. The technical basis could include matters such as arrangements for the coordination of frequencies or for site approval, verification of space segment access arrangements, issuing of network numbering schemes, practical arrangements which facilitiate contacts with prospective licensed satellite network operators in case of an emergency, practical adherence to specific national conditions in conformance with Community law etc."

"As a second step, the Commission will test the provided technical basis against Community law and policies, in particular telecommunications policy; after which common licensing conditions will be adopted. In accordance with the responsibilities conferred on the Commission by the Directive."

One Stop Shopping Timetable

Fairly tight timetables are set down for the issue of licenses under the one stop shopping arrangements. When a service or network provider files with a national organisation for a license, that organisation must notify national regulatory authorities involved within seven days.

The national regulatory authority responsible for issuing the license must take a decision and inform the applicant within six weeks of receipt of application.

LEO's

The draft also addresses the issue of new service categories for which harmonised Community licensing conditions have not yet been agreed, such as services from non-geostationary satellites and in cases where certain satellite services might not be covered by any of the established service categories due to the uniqueness of the service for which a license is sought. Under such circumstances, applications for mutual recognition can be dealt with under transitional one stop shopping until harmonised conditions for the service category in question have been elaborated.

The Community Telecommunications Committee (CTC)

The EC intends to use the CTC as the vehicle to implement the directive at Community level. The CTC is composed of representatives of national regulatory authorities of EU member states. However, most of the major tasks of implementation of the directive will be taken at national level. The CTC will also be used as a conciliation body when appeals are made to the Commission.

Bad News for the USA

The Directive will give rights to satellite service providers or network operators only if they are owned through a three quarters majority ownership by member states and/or national of member states. "That means that a US owned SNG operation, for example, could be forced to continue to obtain licenses at national level and have a separate license for each of the 12 member states. In practice it looks to be more of a vehicle to keep U.S. common carriers out of the European marketplace. Indeed, European organisations are currently specifically prevented from obtaining common carrier licenses in the USA.

The draft directive states that the protectionist measures "will remain to be applied until satisfactory completion of bilateral or multilateral agreements which allow a more balanced developments, or until the developments of the satellite sector requires a review of these provisions...."

Essentially this is a GATT services issue covered in last month's final meeting or the Uruguay round.

It appears that the clauses are likely to lead to a lot of lobbying by US interests.

Germany: Berlin-Bonn Datalink Proposed

94WS0033A BERLIN INGENIEUR DIGEST in German Oct 93 p 28-29

[Text] The government's move from Bonn to Berlin must not allow political tourism to explode. Telecooperation and a multimedia datalink are supposed to keep the travelling frenzy within bounds.

Albert Noltemeier refuses to accept at least one argument from those opposed to the government's partial move from Bonn to Berlin: "Effective cooperation is also possible over great distances," maintains the expert from the Society for Mathematics and Data Processing (Gesellschaft fuer Mathematik und Datenverarbeitung mbH, GMD) in Sankt Augustin near Bonn.

Noltemeier knows what he's talking about. The national research institute itself has long been testing work in "distributed organizations." As early as last summer, the society set up more than 30 teleworkstations at its headquarters in Schloss Birlinghoven and in locations in Darmstadt and Berlin. The datalink functions via telecom's switched broadband network with a bandwidth of 140 megabits per second. The workstations are each equipped with a computer, audio and video accessories, and the necessary applications software.

This is testing the future of the "innovative Bonn-Berlin datalink" (Informationsverbund Bonn-Berlin, IVBB), developed for the Federal Ministry of the Interior by the GMD together with partners at universities and in industry. The project bears the name POLIKOM. The term is a combination of the Greek polis (cities) and communication. Prof. Dr. Dennis Tsichritzis, GMD's chairman of the board, sees implementation of the link as an "outstanding opportunity for the exemplary use of cooperation and communication technology in Germany."

POLIKOM, for which the federal government will spend at least 120 million marks by 1997, should give Germany a leading position in the area of multimedia technologies. Economic researchers estimate that the market for high speed communication systems will boom. With components for this technology, sales could grow from almost $20 billion to about $55 billion by 1997.

US President Bill Clinton declared the national networking of the states with data connections as being among the most important tasks in building up the infrastructure. Total cost: $500 billion over 15 years. Whether or not Clinton can mobilize these gigantic sums in view of pressure to cut costs in the American budget remains to be seen. Germany, however, with Bonn and Berlin as separate seats of government, needs a modern communications link. Industry is also urgently seeking possibilities for faster data transfer.

And in a united Europe, it would be almost essential for survival. "European integration will put demands on all forms of government to coordinate and integrate their functions," says Dr. Nigel W. Horne of KPMG Management Consulting in London. However, this sort of cooperation and communication can hardly succeed with today's methods, which, along with telephone and fax, are characterized in particular by automobile, airplane, and train travel. In Great Britain alone, according to a traffic study, job-related car travel amounts to about 170 billion kilometers each year. Depending on the size of the company car, that corresponds to billions of liters of gasoline, which, moreover, are increasingly often frittered away uselessly in traffic jams. Horne is not the only one convinced that "effective communications systems, which reduce the need to travel, can contribute to energy conservation."

POLIKOM managers have already outlined a scenario of how that could function: A member of the Bonn Bundestag who wants to lead talks in his district, see how construction is coming along in Berlin, and take part in a committee meeting usually needs two to three days to do it now, suffers a lot of stress, and travels many kilometers. With POLIKOM technology, the representative could manage this all in a single day, largely stress-free and without having to leave his office.

Telepresence and telecommunication are the technical terms for this. In the future, says Dr. Josef Schaefer, program manager of the project, telepresence techniques should make it possible "to hold working meetings with participants in different locations using the same databases, transparent presentation media, and with joint work on the same document." That is far more than today's videoconferences already offer.

Figure 1. Telepresence: Collaboration hundreds of kilometers apart. [Figure not reproduced]

In general, the systems must assure the exchange of information between partners in different locations, facilitate collaboration between widely scattered sites, and support the cooperation of groups over relatively great distances.

Through joint viewing of documents, telepointing, and joint editing, mediated by data lines, this should operate as if the coworkers were sitting in a single building on several different floors, as commonly happens today.

In telegroup work areas, it must be possible for discussions to take place in which everyone has rapid access to the same archives, records, and documents. Personal teleworkstations should facilitate rapid contact with each other over hundreds of kilometers at any time.

In this way, telecooperation, the shared performance and coordination of tasks, should become possible. In POLIKOM, a sort of personal assistant is supposed to organize tasks, manage and monitor deadlines, and perform secretarial duties. Information can be obtained

quickly from a multimedia archive. Encoding functions and electronic signatures should provide for data security.

Figure 2. Datalink: Multimedia documents from the electronic archive. Features include: decentralized information sources; records and written document management; multimedia archives; organizational knowledge bases and other sources of information; distributed telecooperation workstations; personal files; data switching; network access. [Figure not reproduced]

All are functions which are available at least in the early stages today, but which must still be integrated into a whole. In today's prototypes of POLIKOM teleworkstations at the GMD—cost per workstation about 50,000 marks—some of these functions are already being tested: video-tools, multi-media-mail, an organizational knowledge base, an activity assistant, or the security system SECUDE with chip card terminals for electronic signatures.

The technical basis of the system will not only be cheaper in the future, but also considerably more powerful. The most important point however: The systems must be so reliable and easy to use that they are accepted.

This is what GMD wants to test in practice. In the Cologne-Bonn area, it is currently working on a project in the area of industrial development. A structural development company, founded in 1991 on the basis of the Berlin resolution, is to insure the future of the region together with several industrial developers—soon supported by multimedia functions and telecooperation.

Germany: Participation in Polar Studies in Antarctica Reported

94WS0033B BERLIN INGENIEUR DIGEST in German Oct 93 p 31-32

[Text]

Arctic Fusion

The ozone hole, the greenhouse effect, and climatic catastrophes continue to bring the Antarctic publicity as a crucible of weather. The fusion achieved between former East and West German polar researchers caused less of a sensation.

Polar researchers at the Alfred Wegener Institute for Polar and Oceanic Research Bremerhaven made out well during "ceiling control," which in plain English means last year's freeze on national research institute budgets by the BMFT (Federal Ministry for Research and Technology). Mention of their participation in the international Global Change Program, which is aimed at studying global environmental change, protected them from the red pencil.

The Germans can make a traditionally significant contribution to tracking down global changes, especially in the Antarctic. In 1976, GDR researchers set up their own research station to study solar-terrestrial relationships in the Schirmacher Oasis in Queen Maud Land, which later was given the name "Georg Forster." After the conclusions of this program, isotope physicists and chemists from Leipzig, geologists from Potsdam, and geomagnetists moved in.

The first Federal German station, "Georg von Neumayer," was built in 1981. With the German-German fusion of polar research, the question arose whether and how operation of the stations should be continued. Result: "Forster" is being renovated, but in the future it will only be used as a summer base. The budget afforded no more, especially since the old Neumayer station on the Ekstrom shelf ice in western Antarctica had to be given up and replaced by new facilities in 1992.

What too seldom works out in other cases went well here. East German polar research was given an exceptionally positive assessment by the Science Council. AWI director Prof. Gotthilf Hempel, chairman of the evaluation committee, even raved about "a pearl of former GDR Academy research." There was no duplication of West German goals. Structurally, of course, there were adjustment problems. Earlier, a maximum of six staff members of the Academy's Central Institute for Geophysics in Potsdam prepared and coordinated the expeditions logistically. Scientists from various institutions carried out the research itself. After unification, it was decided to expand the Potsdam working group to an AWI research center. The staff was increased to 40, 20 of whom are scientists.

Corresponding to the marine specialization of the AWI parent institute, continental activities went to the Potsdam group. In addition, atmospheric research using radio-equipped weather balloon ascents, radiation measurements, ozone exploration with lasers, and spectroscopic detection of aerosols are increasingly being undertaken. One group of the Bremerhaven scientists involved with this area has moved to Brandenburg. "Certainly the long tradition of East German research on the Antarctic atmosphere influenced this decision favorably," believes research center director Dr. Hans-Wolfgang Hubberten. GDR scientists, he acknowledges, "were the first to measure the vertical structure of the ozone hole continuously with balloon probes." This longest and most complete series of measurements will be continued in the future at the Neumayer station. "But aerological investigations as well as total ozone measurements on Spitzbergen will be made and evaluated by us," says Hubberten. His goal: To maintain the good image of the Potsdam research center and to polish it up with new ideas and findings.

Germany: Siemens Researchers Develop Neural Net

94WS0033C BERLIN INGENIEUR DIGEST in German Oct 93 p 32

[Text]

Synapse is Faster

Neural networks for specific applications on conventional computers are already marketable. The trend is towards universally applicable neurocomputers made of special hard and software. Siemens researchers have developed such a high-power computer.

The modern broker no longer depends only on his nose. Nor must he rely on the supernatural. The computer forecasts stock trends for him with greater probability.

Conventionally structured computers must suffice for such tasks. Complex interrelations of this sort cannot be completely described mathematically. The usual devices with von Neumann architecture can only process given algorithms sequentially, and then only if the input information is complete.

It is precisely this handicap which is overcome by specific software which imitates the functions of the human brain, the neural network.

The brain, working together with nerve fibers and sensory organs, can comprehend and classify things, even if the input information is incomplete. The information is stored associatively, i.e. in specific interrelations. This makes the brain capable of learning. Since it builds up its connecting structures itself in accordance with actual conditions, it is also self-organizing. Millions of neurons work as active processors, linked by nerve fibers (axons) terminating in contact points which are connected in parallel to each other. In the brain of an adult human, there are approximately 10^{13} such synapses.

A neural network imitates brain function in a greatly simplified fashion using mathematical algorithms. Like its human counterpart, it is capable of learning and can thus be trained to recognize specific patterns. Numerous models were developed for this, from the simple algorithm with hardwired neurons to models in which the connections are formed by self-organization.

First generation applications like the stock market forecaster mentioned in the introduction run on powerful workstations or other conventional computers. However, real time processing of language, processing of moving images and complex controls can no longer be carried out in this way. Therefore the trend in hardware is towards special components and chips (ASICS), which are significantly faster.

Heretofore, solutions have been tailor-made for special uses and have not been universally applicable. Therefore, at the Central Research Department of Siemens AG in Munich they have gone one step further with a two-year project on the SYNAPSE-1 neurocomputer.

"Our goal," says the director of the development team, Dr. Ulrich Ramacher, "was to build a neural special computer on which the simulation of any desired neural networks and learning algorithms is possible." The Munich researchers have used a new system architecture for the neurocomputer, developed the MA-16 signal processor, and created their own software. Prior to this, various network models were analyzed. Dr. Ramacher: "The analysis showed that there are 25 different compute-bound basic operations for which it is worth developing a special chip. That is what we have done."

The result is the largest pure logic chip developed at Siemens. It has 610,000 transistors on an area two centimeters square. Its more than 200 connections and clock frequency of 50 MHz allow an input-output rate of 10.9 gigabits per second. At the same time, the architecture of SYNAPSE-1 was so designed from the beginning that processor performance and memory size can be adapted to specific applications.

Dr. Ramacher is proud that SYNAPSE-1 is at least 8,000 times faster than conventional solutions. One hour of computing time on the neurocomputer corresponds to 8,000 hours on the latest SUN-Workstation. At this year's CeBIT in Hannover, Siemens researchers showed a sample application in which eight incomplete images were reconstructed in 62 milliseconds. For one such image, a workstation would have taken longer than two minutes.

Germany: Laser TV Prototype Described

94WS0123A Berlin INGENIEUR DIGEST in German Oct 93 p 26

[Article by Guenther Ludvik: "Beautiful Bride"]

[Text] A dream becomes reality, exults Hans-Juergen Thaus, chairman of the board of Schneider Rundfunkwerke AG, Tuerkheim. Home movies "with a screen measuring in square meters, which shows even the smallest details of the picture with unimagined sharpness and the whole range of colors."

It will be a few years until this happens, however. Initially, the 50-man development crew at Schneider in Allgaeu presented only a prototype of the new television generation, after five years of work and expenditures amounting to double digit millions. It works with expensive gaseous lasers and needs a cooling unit the size of an armoire. Although not ready for the market for a long time yet, the technological achievement itself is described as "considerable" by entertainment electronics giants. The industry is urgently in need of innovations in order to revive the market. In Germany, after the unification boom, sales of color televisions dropped from 5.75 million units last year to no more than 5.5 million this year.

Laser TVs, although not an entirely new idea, would arrive right on time. The technology sounds simple but it is bulky: Using a red-green-blue laser beam bundle, a projector shows colored images on a screen, analogous to today's picture tubes, in which electron beams are modulated by the video signal and conducted in rows across the screen. However, precisely this control is causing problems with the laser technology.

What works in the picture tube with changing magnetic fields does not work with laser light. It can be done with mechanical methods, such as mirrors, but the required speeds are extremely high. With an ordinary television picture the pixels write 25 times 625 rows per second, equalling 15,624 times across the screen. For HDTV [high-definition television] or flickerless 100-Hertz images, which are the future particularly for large-screen projection, they must be twice as fast. Schneider's R&D chief, Guenther Elster, and project leader Christhard Deter insist that they have mastered these technologies. However, the micromechanical know-how will not be revealed until all patents have been secured.

It is conceivable that small polygons will be used as mirrors, which rotate or swing around their axis. This beam-deflection technique requires intermediate storage of the image information in a digital memory, which passes them on in correspondingly modified timing to the laser. A great deal must still be done, above all for the laser technology. Only semiconductor-diode lasers can offer small size and low prices per unit. They have proved themselves in large-scale technology, for example in CD systems. "For the colors red and green the light intensities obtained today are already in the range of data specified for multilaser projection technology," says Professor Gunther Krieg, Dr. of engineering. For blue-light systems, however, "solutions can only be expected in the next two years."

Thus, the first projection units in video recorder format for DM 3,000 could be available three years from now, at the earliest, in the opinion of Hans-Juergen Thaus. Middle-size enterprises do not have the staying-power and, above all, the financial strength to develop laser projection until it is ripe for the market. Schneider is therefore looking for partners in the industry, but there is mostly skepticism. Many contracting parties have already been involved with similar technologies but given up. At least half a dozen other companies could also demonstrate that the idea in principle does function. But if laser TV were to break through, most would have to worry about their large capacities in the production of picture tubes or LCD displays.

Nevertheless, the PR show has had a positive effect for Schneider: The value of a share, which was introduced in 1986 at a price of DM 540 and which had meanwhile plummeted to DM 112.50, in early August climbed to DM 423. Thaus is now hoping that a U.S. company with a lot of capital will step in: "After the world premiere, the bride has become a great deal more beautiful."

EC To Propose 16/9 HDTV Format Directive

94WS0153C Paris AFP SCIENCES in French
25 Nov 93 p 11

[Article: "New EC Proposal on HDTV Transmission Standards"]

[Text] Brussels—The European Commission [EC] is going to propose a new directive (Europe-wide law) on high-definition television (HDTV) to promote popularization of wide-format television (16/9 width-height ratio) that will be applicable independent of the transmission standard used, according to Community sources.

This new proposal follows the Twelve's decision last June to promote wide-screen television in the HDTV action program and abandon any reference to a single, mandatory transmission standard. Initially, the Commission had planned to make the D2-MAC and High Definition-MAC (HD-MAC) standards obligatory.

The new proposal, to be submitted to member states on 7 December, provides that television services transmitted to viewers by cable, satellite, or ground-based broadcasting stations must utilize either D2-MAC or a transmission system 100 percent compatible with PAL or SECAM standards. Among other things, that should permit use of the German "PAL Plus" standard now under development.

For services not fully digitized, the Commission proposal endorses the HD-MAC transmission system. Experts expect digital transmission standards to evolve rapidly in the coming years. The Commission stipulates however that digital transmission systems will have to be "standardized by a European standardization body."

The proposed directive also says that "any wide-format (16/9) television service that is picked up and rebroadcast by cable systems must be rebroadcast in the wide (16/9) format."

France: Telecommunications Techniques, Prospects Described

94WS0238A Paris L'ARMEMENT in French
No 40 Dec 93 pp 84-90

[Article by Pierre Fuerxer, Danielle Le Gourrierec: "Telecommunications Techniques, Prospects"]

[Text]

Perceived Need

In the Gulf War as well as in the landing in Somalia, news reporters had extremely advanced communications resources, at first glance, more advanced than those of the military. But those two examples—the tip of a deeply submerged iceberg—are not representative of all the events and their diversity. To set up their own communications, the military could not rely upon the technical,

political and economic opportunities that made possible the extraordinary media coverage of recent operations.

The military telecommunications system of the year 2010 will not entail the mere transfer of civilian solutions in gestation at France Telecom or in the research laboratories of the major French, European, U.S., or Japanese industries.

Civilian telecommunications currently are already displaying typical features of a basically market-oriented development. Areas having heavy population density or generating large volumes of traffic are and increasingly will be emphasized. Investments, too, will be concentrated on the most "profitable" communications services. In contrast, the military has to be able to communicate *from everywhere to anywhere and with anyone* . They will have to be guaranteed a full-spectrum leading-edge service no matter how heterogeneous the resources rendered operative. Defined in this way, their requirements are too varied to be met fully and directly by off-the-shelf purchasing of such products or civilian systems.

Civilian investments, however, are not comparable to those authorized by the armed forces. For this reason, if the military telecommunications system, a meta-system harmoniously and effectively incorporating the "fixed" segment and the "tactical" segments, relies on the humongous technological effort that the telecommunications industry has made, it will incorporate developments appropriate for meeting specific requirements.

Future Trap

Technological progress will lead to an unprecedented development of data exchanges. An easy way to conjure up tomorrow's telecommunications is based on France Telecom's Eurodisney attraction entitled *It's a Small World* . In a scaled-down world, the latter displays a host of individuals who spend virtually all their time on the telephone or watching cartoons. Will technology enable everyone at any time to have all the data that one could wish to receive at the risk of no longer being able to choose among the data that will be submitted to that individual? Will the military itself not be overwhelmed by the load of available data and, mesmerized by the data, become incapable of making decisions and taking action? Will the world of telecommunications be the golden age that humanity dreams of or will it be a nightmare?

Reduced Distances and Technological Innovation

In the near future all transmittable signals will be in digital form. The transfer rates necessary for the different services will be highly varied, going from a few bits per second to tens of megabits per second. The transfer rates needed for different source codings will be heavily dependent on the desired quality. Music coding will be done for transfer rates varying in a ratio of 10. For speech, the ratio will approach 100. For images it will exceed 1,000, including videophone and the high-quality television necessary for productive societies. The transfer rate for data transmissions, in turn, will be limited only by computer memory access times. The rapid escalation of communications capacity will lead to a considerable subjective reduction of distances. A distant correspondent will be as easy to reach as the neighbor down the hall.

Optical fiber is now being used in transatlantic cables. The TAT 9 cable that was put into service in 1991 between Europe and the U.S., makes it possible to transmit 560Mbits/s. In 1995, TAT 12 will make it possible to transmit 5 Gbits/s, that is, 60,000 telephone communications. In the laboratory, the National Center for Telecommunications Studies [CNET] is experimenting with a 20 Gbits/s 108 km link. For sure, before the year 2,000, 100 Gbits/s will be realized with multicolor systems, that is, employing several optical wave lengths.

Satellites will mainly be used for the broadcasting of images. For data transmission or telephone channels, the increasing congestion of the geostationary orbit and the saturation of the spectrum will increasingly lead to reserving the use of digital telecommunications satellites for covering the oceans and desert areas. Possible development of clusters of low-orbit satellites is not likely to check this trend.

It will be difficult to transfer this development into the military sector, nor is it certain that there is a real need to do so. The innovative technologies that will directly interest the military and impact its transmission system will be those being investigated for radio broadcasting and digital radio telephony for mobile units.

In effect, the features of the modulation that is used make it possible to counter radio channel distortions. *Digital Audio Broadcasting* [DAB], undergoing experimentation, will surely be the first application of that technology for digital radio broadcasting. It will therefore be possible on a single transmitter to multiplex six different stereophonic programs and to transmit 1.3 Mbits/s in a 1.5 MHz channel.

What is more, all transmitters broadcasting the same group of stations will use the same frequency. That will noticeably reduce the congestion of the spectrum and even do away with the concept of frequency plan. The same principles will soon be applied to television. It will be possible to transmit 5-20 Mbits/s in a current TV channel to fixed or mobile receivers. There too, multiplexing of several programs on a single transmitter will be possible.

Even if protection against electronic warfare might restrict the effectiveness of the subsets of a military telecommunications system using such solutions, the interest that such techniques could afford for broadcasting data to forces deployed in theaters of operation can be imagined.

Concurrently, mobile radio telephony will continue to develop. Systems like *Itineris*, based on the GSM [Global System for Mobile Communication] standard, will be supplemented by new systems occupying other frequency bands. Wireless telephones like *Bi-Bop* will be increasingly used. Wireless local-network and private switches will emerge. Ultimately, short-range links with mobile units will develop around various applications: navigation and traffic control, as with *Prometheus*, automatic toll collecting, or even detection of stolen vehicles.

To be sure, military systems will resort to the same techniques without necessarily realizing the same effectiveness since they will have to be shielded against the occurrence of electronic countermeasures and incorporate data security.

Frequency Spectrum Management

Frequencies are a very rare commodity. Civilian pressure on the military is already strong and could even intensify since the new market shares that use of frequencies currently allocated to the military represent for civilian operators are quite sizable. Besides the scarcity of military bandwidths, being side-by-side with a very large number of civilian systems and involuntary disturbance phenomena will require the introduction of a very strict management of frequency usage, transmitting powers and a very precise definition of radio equipment features.

Forwarding of Data

Conceivably, use of rapid packet switching technology or *Asynchronous Transfer Mode* [ATM], adopted in the combined forces *Socrate* system, will become widespread. All the data to be transmitted will be submitted in a single fixed-length format that is especially well suited for real-time switching. With the upsurge in data transmissions among computers, the required transfer rates will be increasingly large and sporadic.

The very broad heterogeneity of the channels making up the military transmitting system—optical fibers, satellite links, Hertzian link-ups—will be even further intensified by the presence of degraded modes during electronic warfare.

The switching system capable of optimizing the use of all such transmitting resources will be extremely complex. An increasing amount of transmission channel capacity will be dedicated to management data exchanges. In effect, it will require transmission of all the data needed for operating the services proposed for users and system supervision. In military systems that are simultaneously adaptable, reconfigurable in real time shielded against intrusions, the development of switches will be especially difficult. In fact, the switching system will be a major shared computerized application. Already in *Rita*, the option made was to make the software more complex in order to facilitate deployment of the system and its operation. This trend will be continued with ease of operation for the user always being the underlying parameter to be emphasized.

Civilian Sector Services

Standardization of transmission channels combined with increasing software programming is going to lead to a diversification of services. Initially, source coding will be increasingly suited to each application: wide-band sound, video-conferencing image coding, color facsimile coding, etc. A number of those signals could be combined in a transmission channel to create a multimedia service.

Subscriber mobility, a service originally offered by the lone tactical system *Rita*, will become a reality in civilian systems and all military systems.

An apparently complete freedom of movement for subscribers will result from the development of Hertzian link-ups.

At present, systems having a shorter range like Bi-Bop are surfacing. Micro-cellular system design with a 200 m or less close-in range is emerging. Its short range is offset by the universal availability of terminals for connecting to an optical fiber based wire system. Since users are unaware of the constant changing of their connecting terminal they therefore have a feeling of absolute freedom in their movement and the impression of an unlimited range for their portable telephone.

To conjure up the impact that the telecommunications development could have on our lifestyle, let us imagine a Parisian on vacation somewhere in the heartland of France in the year 2,010. His car's on-board computer takes him unswervingly to the sight, described in his travel guide, that he decided to go admire. On the way back to his hotel he decides to take a route through the woods. Covering hardly 100 meters, an alarm points out to him that he is no longer on a listed roadway. A few meters further on, his radio telephone informs him that, without a satellite terminal, he has lost all "civilized" contact and will not be able to be rescued in the event of an accident.

What will the effectively developed services be? Will they help improve the quality of life? Those are the real stakes in this impressive technological development. What will the behavior and reactions of the military personnel be, who, in civilian life will be "conditioned" by such an environment? The outlook in this sector continues to be quite difficult!

Specifically Military Services

In the military systems, the impressive transmission capabilities made possible by the technology will facilitate broadcasting to the lowest command levels, even to the troops, intelligence in the form of texts, sounds, or images. Command systems likewise will be able to receive all the data they will need. In exchange, such systems will have to merge increasing amounts of data.

An increasing de-localization of functions will be noticed as well as the emergence of shared weapons systems whose elements, specialized by function, will cooperate for the extent of a mission. Already, during operation *Desert Storm*, computing the necessary elements for

aiming the *Patriot* missiles was done in the U.S. on the basis of data collected by the various available sensors. Is it to be feared that all decisions will be made by a staff, far removed from ground truth? Be that as it may, telecommunications flexibility will facilitate the development of designs for the employment of forces. But it should never be forgotten that electronic warfare will bare any blind alley or indiscretion made in the design stage and that there is no allowance for error.

If the geographic spread of conflicts requires increased interoperability with civilian systems, it will also be necessary to be able to dispense with local infrastructures that have been destroyed or that are in the hands of non-controlled elements.

Standardization in the Civilian World

In upcoming years, the intense creativity of telecommunications, on the digital signal processing level, equipment or systems and systems and services will engender two opposed movements. First, the proliferation of concepts will lead to the development of mutually incompatible technologies. It will be hard to choose among them. Second, the complexity of the systems will require the new products to adhere to precise standards enabling their introduction into the systems. That holds for equipment as well as services even if the so-called "smart system" structure will ease their introduction by making it possible to export the necessary software in the servers.

In the civilian world, the "deregulatory" movement launched in imitation of the U.S., could lead to a diversification of technical options among competing operators. Absent a firm policy aimed at requiring systems interoperability, the result could be a lowering of the quality of service in the eyes of the customers. If the operators are dynamic enough, the emergence of de facto standards will be noticed, as in computers, and, with the interplay of alliances, the establishment of very large transnational groups on the international level. Otherwise, initial commercial failure will delay development.

In London, for example, cut-throat competition among four operators caused an initial attempt at introducing a BI-BOP type service to flop while it enjoyed absolute success in Paris. In turn, development of the pan-European GSM radio telephone demonstrates that voluntary awareness by all the economic players of the interoperability problems can lead to a major industrial and commercial success while allowing operators to multiply. Therefore, standardization is an extremely major stake in the future of civilian telecommunications.

In military systems the interplay is unquestionably even more complex. To hold down development costs, it has to be able to derive maximum benefit from the investments made in the civilian world while allowing for military specifications: security, confidentiality, shielding against electronic warfare. That is possible only if the military, considered as a minority operator, participates in one form or another in the elaboration of civilian standards. Too frequently, a haphazard selection at the commencement of the standardization process makes it easy or impossible later to adapt the products to military requirements. The basic options, therefore, should be made with an awareness of the case.

Unlike what happens in other sectors, in telecommunications, the definition of standards precedes the development of the prototypes. Systems or services conjured up the engineers are specified and then standardized before springing into existence. Except in rare sectors not involving interoperability, innovation no longer can arise from an individual initiative but from a consensus that is all the more difficult to realize because the interests of the different parties are frequently at odds. The ability to persuade, therefore, is becoming an essential quality in engineers, an indispensable supplement to their technical expertise.

Telecommunications already have greatly impacted our lifestyle. In the past, the telephone radically altered the relationships among individuals. Presently, the fax is transforming our work style by eliminating the mail carrier's delivery routes and abolishing delays in the transmission of documents. In the future, when the videophone becomes less expensive, it too will alter social behaviors.

In the civilian world, development will occur because of a compromise between the disorder stemming from the development of new designs and engineering consistency that is the only thing able to allow different correspondents wishing to communicate to make themselves understood. Development will no longer be limited by engineering possibilities, but rather by the slowness of the standardization process, the investment burden to be amortized or even the difficulty in realizing a threshold of profitability for a new service.

Military systems should supply quality services comparable in all respects to those offered by their civilian counterparts. Even more than in the past, those in charge of developing military systems will not tolerate anything less than total availability for the transmissions they will require.

Only military systems are designed to completely dispense with the support of local infrastructures. Equipment manufacture in small series and durable in a very hostile environment cannot be compared to unshielded civilian systems. On the other hand, they should be interoperable with them in order to be able to afford the military optimum effectiveness under all circumstances. Military telecommunications have to remain operational in a major conflict. They will benefit from the development of civilian telecommunications but there will be no correspondence between the services offered by civilian telecommunications and the requirements of the military. Therefore, the systems cannot be identical.

In this article terminals have been dealt with only through the intermediary of the services. By the year 2,010, what will the user interface look like? In a period of office communications what will the operational modes be that

will be deemed ergonomic by the next generation? A further unresolved issue: besides civilian systems, with what others will it have to be interoperable?

German ISDN Development, Links With Euro-ISDN Noted

94WS0206B Heidelberg NET—NACHRICHTEN ELEKTRONIK + TELEMATIK in German Dec 93 pp 569-572

[Article by Volker Fink: "Start in the Mass Market"]

[Text] The connection of ISDN [Integrated Services Digital network] had developed into a sought-after product on the German telecommunications market. The official startup of Euro-ISDN in December will give the digital network an additional boost.

In the past years a number of countries have introduced ISDN. But there were no extensive ISDN standards, so that various performance characteristics and features were being used for connections in the individual countries. Above all, local ISDN terminal equipment and applications were confined to use in each country, so that each country developed its own terminal equipment. The result of this greatly limited the marketing opportunities, which also led to low production numbers and relatively high unit prices.

In order to counteract these problems, 26 network operators from 20 European countries have committed themselves to introduce an ISDN based on a uniform European standard by the end of 1993. Telekom has also signed this agreement. It was determined that every network operator should offer both basic and primary multiplex connections. In addition, a minimum of services and performance features must be supported. Beyond that, however, every network operator is free to offer additional performance features, but he must use the international standards. The minimum range includes:

- 64 kbit/s transmission service (transparent transmission of 64 kbit/s without limitation),
- 3.1 kHz audio transmission service,
- transmission of the calling number to the subscriber called,
- suppression of transmission of the calling number
- digital information display through to the extension in telecommunications facilities,
- multiple number dialing
- interchanging at the passive bus of the multiple equipment connection.

With Euro-ISDN the user thus has the advantage in the future of being able to use a large, high-capacity, and inexpensive international range of terminal equipment.

It has already been established that this is not just a future vision. Thus, as of January 1994 Telekom will offer a modern Euro-ISDN telephone at the cost of not quite 300 German marks [DM], which can be used with all current Euro-ISDN performance features. Small ISDN telecommunications facilities at a cost of DM 1,000 will be available approximately in mid-1994, and many experts anticipate that the price of passive ISDN PC adapter cards will shortly drop to about DM 200.

Another important advantage with Euro-ISDN lies in the users being able to employ their ISDN applications and communications solutions without change in various countries, which greatly simplifies international communication.

Introduction of Euro-ISDN in Germany

Telekom began to implement Euro-ISDN in its network in August 1993. The only thing needed to make Euro-ISDN available is to change the software at the switching center. Hardware changes at the switching centers or the subscriber's network end is not necessary. The introduction of Euro-ISDN is so simple because international compatibility involves only signalling on the access line, the D-channel protocol.

For technical reasons the introduction of the new software can only take place in stages, however, so that Euro-ISDN will not be available nationwide until April 1994. In regions where the work has been completed, customers can already be connected before that. The startup of regular operation took place on 1 December 1993.

With the introduction of Euro-ISDN, Telekom will offer both the national (1TR6) and the European D-channel protocols (DSS-1) in its network. Each user can then decide whether he wants to use an ISDN connection with the national or the European standard. This applies to both existing connections and to new installations. The conversion takes place individually for each connection at the switching center. No changes are necessary at the network port. For connections between ports with various protocols, the conversion is carried out by the network.

How long national ISDN will remain part of the features offered will be determined mainly by market requirements. Telekom plans to offer the choice between ISDN connections with national or European protocols until the year 2000.

'Bilingual' ISDN Base Terminal

Due to the different D-channel protocols, a 1TR6 terminal unit cannot be operated with a Euro-ISDN port. Conversely, it is also not possible to operate a Euro-ISDN terminal unit with a 1TR6 connection. Since Telekom will offer both D-channel protocols simultaneously in its network, and the customer himself can decide which standard he wants to use, this limitation is not significant with only one end unit. This applies in particular to ISDN connections of telecommunications facilities and computer centers.

With Euro-ISDN Telekom will also offer a bilingual basic connection for multiequipment configuration (basic connection with passive bus), in which both standards are available simultaneously. For this a modified network port must be installed at the subscriber's which uses the European D-channel protocol toward the ISDN switching center and at the subscriber network interface (S_0 interface), in addition to the European D-channel protocol, also the 1TR6 protocol. This makes it possible to operate terminals with the national and European standard at the same time with one and the same basic connection.

Bilingual primary multiplex connections are not possible for technical reasons and are therefore also not planned. If a telecommunications facility is connected through several ISDN ports, however, some of the ports could use the European D-channel protocol and the other ports the 1TR6 protocol.

Services and Service Features with Euro-ISDN

With the introduction of Euro-ISDN, Telekom offers a spectrum of services and service features which are clearly above the minimum range required. There will be many performance features which are not in the national ISDN and which make new applications possible. Some performance characteristics will also have new properties which permit even more comfortable communication. An example of this is "multiple dialing."

This feature replaces the previously well-known "terminal selector character." With the terminal selector character it was possible to select each equipment specifically in the event several terminals are connected to an ISDN port. While in 1TR6-ISDN exactly 10 numbers are available in ascending order at a multiequipment port with the addition of another position to the ISDN call number, in Euro-ISDN up to 10 numbers can be defined as multiple call numbers. These can be any free numbers from the volume of call numbers at the switching center. This means that when changing over to Euro-ISDN the customer can keep his previous call number if he is already connected to a digital switching center. Basically, one can say that the service features of the national ISDN are connection-related, while in Euro-ISDN they are call number-related. For the user this has the advantage that he can use the service features for each multiple call number separately. Example: In rerouting a call, the entire connection is no longer transferred; instead, various rerouting destinations can be entered for each multiple number dialled.

Additional features will be added over the next few years. In addition to three-party conferencing, special mention may be made of "partial rerouting" which will be available after 1994/95. With this feature rerouting calls from telecommunications installations will be possible for each individual extension.

The "reserved permanent connection" feature (old name: semipermanent fixed connection), for which there is still no European standard at this time, will not be offered so far. "Three-party conferencing" will not be possible to use until the end of 1994.

Euro-ISDN Rates

Regarding ISDN rates it is necessary to distinguish between connection rates for basic and primary multiplex connections and for traffic rates. The traffic rates correspond to the normal analog telephone connection. For that it does not matter whether you call or send text, images, and data. There will be no service-based rates. Telekom thereby differs from some other countries, in which non-voice communication carries different and in part higher charges than voice transmission.

However, the Euro-ISDN connection involves a new product with new features. That is the reason why Euro-ISDN rates are different from the rates for national ISDN. Basically, there will be separate tariff items for a Euro-ISDN connection without features, as well as for all features which can be switched on separately. Telekom is obligated to do this based on directives from the Federal Ministry for Posts and Telecommunication and the EC Commission. For reasons of handling and clarity, two cost packages are planned in which ISDN connection and features are bundled. The two packages offered are called ISDN Standard Connection and ISDN Comfort Connection and are offered in the basic connection variant at DM 64 and 69. At these rates the basic Euro-ISDN connection is DM 10 cheaper than the national connection variant.

Access to X.25 Networks

Euro-ISDN will not only offer new performance features but also the foundation for flexible and inexpensive communication. An example of this is access to X.25 networks over the B and D channel of the ISDN connection, for which Telekom will create the preconditions based on Euro-ISDN. Access through the D channel of the basic connection is particularly attractive for many applications.

The D channel is basically reserved for the signalling of the connection. Information transmission in this channel is packet-oriented and takes place with a transmission speed of 16 kbit/s. Only a part of this transmission capacity is needed for signalling, so that the rest is available for transmission of "useful information."

An ISDN customer can thus operate his basic connection independent of the use of the B channels as a X.25 connection. The access through the D channel is suitable for transmission speeds of up to 9600 bit/s. For higher speeds a B channel must be used.

If a user would also like to utilize his ISDN connection as a packet network connection, he must pay for the use of this feature in addition to the monthly base rate for the ISDN connection. Connection charges in ISDN are not included in the present concept, but the rates for each X.25 network are added. Access through the D channel

of the basic connection will presumably be very inexpensive. As of right now, operation is likely to begin in the second quarter of 1994.

The intended technical solution primarily offers advantages for applications in which only small data quantities must be transmitted per connection and which also have other communications needs. Among them may be mentioned the electronic cash systems in retail sales or booking systems in travel agencies. The advantage is that the users do not have to acquire several different telecommunication ports for language communication and data transmission, which leads to more flexibility and, above all, savings.

UK: JANET Academic Telecommunications Network Expanded

94WS0206A Heidelberg NET—NACHRICHTEN ELEKTRONIK + TELEMATIK in German Dec 93 pp 556-557

[Article by Adrian Morant: "From Janet to Super-Janet"]

[Text] For a decade the local area networks (LANs) at approximately 200 universities, polytechnic colleges and research institutions in Great Britain have been connected to one another through Janet (Joint Academic Network). Janet was installed in the early 1980s, currently serves about 50,000 terminals and offers access to electronic mail services around the world.

This system is now being improved by means of the most modern optical waveguide technology so that in addition to its existing function as a news transmission medium it will also function as a future-oriented communications structure for the academic community. The new improved network by the name of Super-Janet is needed to support certain teaching and research activities. In addition to language transmission, they also require rapid data, image and video transmission. Super-Janet will not replace the existing network but expand it.

Powerful Overlay Network

The new network will not radically change the type and way in which scientists access decentralized data bases and routinely communicate by E-mail with their colleagues all over the world. But it will create a significantly more powerful overlay network, to which gradually more and more facilities all over the country will be connected. After the development of similar networks in other countries, new perspectives will open up on this level as well.

Dr. Robert Cooper, who heads the project for the Science and Engineering Research Council/Universities Funding Council Joint Network Team, regards Super-Janet as "singular in Europe." In explaining the pioneering role of the new network, he adds that it involves a test system for the demanding academic community.

The British Universities Funding Council (UFC) awarded the contract, worth 18 million pounds over a period of four years, to British Telecom (BT). In the first phase data centers at the Universities of Cambridge and Manchester, Rutherford Appleton Laboratory, University College London (UCL), at Imperial College London and the University of Edinburgh will be interconnected. In the course of 1993/94 about 50 locations will be connected to the network. Additional ones will follow, according to the availability of the necessary funds.

The network concept will be realized by means of the latest broadband technology. Most communications opportunities are based on the Switched Multimegambit Data Service Definition (SMDS) by BT. The Synchronous Digital Hierarchy (SDH) is to be used as a central network technology, which together with new broadband transmission methods (Distributed Queue Dual Bus, DQDB, and Asynchronous Transfer Mode, ATM) will offer a maximum of transmission opportunities.

Dr. Alan Rudge, head of BT's research and procurement division, who is responsible for all the company's technical research work, stresses that the broadband transmission platform used to interconnect the locations is just as important for the industry as for government offices and academics: "The Super-Janet order enables BT, together with the universities, to develop new applications which sooner or later will bring the companies a competitive advantage."

Dr. Rudge further refers to the necessity of promoting the image of "broadband as the standard." According to his information, BT is proposing to the industry that it should participate in joint projects with the suppliers in order to offer these facilities. A critical mass is needed in order to stimulate confidence. BT therefore expects that the availability of the network will have a decisive "trigger function."

Broad Application Range

Transmission of visual output data from extensive, fluid-dynamic calculations executed at the Rutherford Appleton Laboratory near London on a Cray YMP supercomputer to Imperial College in London is one potential technical application. Since the enormous amounts of data produced can only be processed by the user if they are present in image form—often with color and animation—Super-Janet offers the advantage that the researchers no longer personally have to go to the Rutherford laboratory.

The Cyclotron Unit of the MRC (Medical Research Council) at Hammersmith Hospital in London also have several facilities for producing pictures of the brain, which are of interest to researchers in other places. In the pilot project these pictures are transmitted for analysis from Hammersmith Hospital to the psychiatric departments of the University of Edinburgh and the University College London as well as for processing by the supercomputer center at the University of Edinburgh.

University College London has the equipment for teaching surgery by means of interactive video. For that reason a proposal was made to carry out a series of surgical demonstrations between the UCL and the other centers which are able to support interactive activities. These can be for example surgical demonstrations from the operating room, clinical demonstrations in the lecture room, discussions between surgical specialists, joint preparation of video-teaching material and investigation of possibilities to use existing teaching materials for self-study in a decentralized teaching environment.

Among the applications in the field of information services are preparation of archival documents and a test project for an electronic magazine, as well as a series of applications which require rapid transfer of voluminous data from one place to another. The former application is to demonstrate inquiry for and preparation of documents with the network. At least seven universities will participate in order ultimately to establish a regular service between the locations. This method is more economical than the existing slow and personnel-intensive borrowing agreements between the libraries.

Super-Janet will enable a multitude of projects—in the most varied disciplines—which are being postponed at this time for lack of a suitable fast network. Furthermore, with every successful application the advantages of Super-Janet are becoming noticed by an increasingly larger circle of users.

Lasers Used to Communicate with Satellites

94WS0186A Duesseldorf VDI NACHRICHTEN in German 10 Dec 93 p 20

["Optical Communications with Satellites: Carl Zeiss Jena Technology Supports ARTEMIS Data Transmission"]

[Text] VDI-N Jena, 10 December 93, M.S. - When the ARTEMIS satellite is launched in 1996, the ESA (European Space Agency) will make practical tests of the effectiveness of laser technology in providing communications between the space vehicles themselves and between the satellites and the ground station. In late November, Carl Zeiss Jena will have delivered the one-meter mirror telescope to be used for this purpose at the ground station situated on the Tenerife volcanic massif.

In three years, when the ESA's ARTEMIS research satellite, equipped with the necessary transceiver module, has been put into a geostationary orbit, one of the most promising projects of European space research of this decade, designated Silex (Semiconductor Intersatellite Link Experiment) will get underway. For the first time in the civilian domain data will be transmitted directly via laser pulses between the French Earth-surveillance satellite Spot 4 and ARTEMIS. On board each satellite will be a 25-cm receiving mirror and laser operating in the 820-nm light wavelength band. In addition, using the same system, ARTEMIS will also be able to transmit the signals received further on to the ground station in the Canary Islands. From the Canaries, the data can then be transmitted by light waveguide, copper cable, or radio, whichever method is preferred, to subscribers worldwide.

German companies, too, especially Carl Zeiss Jena, which is responsible for the optical elements in Silex, have received important contracts through Dara (German Space Agency) for this project that will, providing the general tests with ARTEMIS are successful, be continued from late 1998 with the first commercial communications satellites. On the occasion of the delivery to Dara of the telescope, Dr. Elk Zittow, business manager, stated frankly: "This has been an enormously important contract for our astronomical instrumentation branch, which is currently being rebuilt." The instrument, which cost roughly 2 million German marks [DM], is one of 14 contracts that the company is presently working on for the space program. It had been originally destined for an astronomical observatory in Kazakhstan. Since the original customer was no longer able to pay, Zeiss Jena modified the telescope for its new use. Anthony Dickinson, associated with ESA's technology center, sees many advantages in the use of laser light, which has already found many applications on the Earth. If free transmission is successful in orbit, not only would a reduction in energy use become possible through the better beaming of light but a greater degree of resistance to interference as well will be achieved. Moreover, the limitations on the available radio frequencies and their limited transmission capacity have compelled the search for such new approaches.

Dr. Fritz Merkle, Carl Zeiss business manager, expressed it this way: "An enormously important contract for our company, whose astronomy technology department, now being built up and directed in Jena, possesses technological know-how from both the West's and the East's space programs."

This participation in the European Silex Project is also a helpful contribution to the ongoing debate concerning Germany's competitiveness as a desirable industrial site. As Prof. Ralf Joachim, deputy business at Dara, put it: "In recent years there has been a double digit growth rate in the electronic satellite communications field internationally. Regrettably it has passed Germany by." Joachim continued: "We have to break away from our present 'sub-critical' presence in the ESA; the successful engagement in Silex provides grounds for careful optimism."

Space research and technology, which is sometimes criticized and repeatedly threatened by funding cutbacks, truly advanced economic developments, especially in telecommunications. In Prof. Joachim's opinion, satellite-based data transmission plays "a key role in maintaining and expanding the competitiveness of our service and technological industries." A study prepared by the Euroconsult Company estimates that the

world-wide market volume for civilian satellite communications systems will reach US$79 billion dollars in the coming decade, of which $55 billion alone will be for on-board systems. Of the approximately 144 new satellites to be built in this time frame, about 36 will originate in Europe.

It is Dara's conviction that German industry has—through its own efforts and with some outside funding—produced some outstanding achievements, such as Kopernikus, TV-Sat, and Symphonie, although, it must be admitted, with less satisfactory commercial spin-offs than hoped for. However, the competition remains very uneven because the United States and other countries can help support their space programs through high military development outlays and government technological programs. Consequently, German companies have to be especially innovative and advance new technologies. Optical communications represents one shining example of just such a new technology.

The ARTEMIS scenario, which ESA believes will become the reality after the successful conclusion of the test phase in late 1998, should bring urgently needed advantages for low-flying Earth reconnaissance satellites and for manned space flights as well. The ARTEMIS relay station will not only receive signals and transmit them in the conventional microwave manner to Earth, but will also ascertain whether the laser system will prove to be the preferred technique for reliable and rapid contacts and which frequencies are best. Finally, it is also conceivable that at some future point a laser optical system will also find use in distant missions. "We still do not know the practical limitations of this technology, but I'm convinced we will hear a lot more about it in the fullness of time," Dr. Fritz Merkle of Zeiss asserted. It is now quite clear that the laser system, by virtue of its lower power requirements, will permit the weight of communications equipment to be significantly reduced. This alone will open up completely new opportunities.

Closer at hand, of course, are the tests planned for late 1995, when the Tenerife ground station is equipped with the Zeiss telescope. The instrument, as Mario Lopriore of the Estec space technology center pointed out to ESA, will most probably also be used to search for space junk. An accessory CCD camera, using the optical system of the telescope, reportedly will be able to detect remnant objects from older satellite or rocket engines from the centimeter range.

France Telecom Tests Flight Telephone System

Paris AFP SCIENCES in French 9 Dec 93 pp 17, 18

[Unsigned article: "First Airplane Telephone Communications Using the TFTS System"]

[Text] Paris—On 3 December, France Telecom sent its first telephone communication using the European system TFTS (Terrestrial Flight Telephone System) from a Paris-Athens flight on Air France, according to a statement from the telephone carrier.

The TFTS system makes it possible to establish telephone communications—or to send faxes and data—from a plane to any country by means of automatic dialing. The air-ground link is directly established through specialized equipment aboard the aircraft and a cellular network of stations on the ground, each with a range of 240 km linked to the stationary telephone network.

At the end of 1990, France Telecom joined with several European telephone carriers to create a TFTS network that would gradually cover all of Western Europe by 1994. The telephone carriers are also working with six European airlines (Air France for France) which will begin full-scale testing early next year aboard their planes.

Germany Seen as Vanguard of GSM Mobile Radio Net

94WS0170A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 22 Dec 93 p 8

[Text] The Information Technology Society in the Frankfurt League of German Electrical Engineers (ITG) regards digital mobile radio as a significant improvement in the position of Germany and Europe. They note that the Germans, in particular, not only played an essential role in the development of the new "Global System for Mobile Communication" (GSM) standard, but they were also in the vanguard in the development of the GSM mobile radio net. They also claim that a large percentage of Federal German territory is already equipped with radio stations for the D1 and D2 nets which use the GSM standard. By 1995, 95 percent of the territory should be included.

GSM is the prerequisite for mobile telephoning without borders: 28 countries, including the CIS, China and Australia, want to install GSM radio nets over the next few years. When that has happened anyone within these countries who has a GSM mobile phone can access the net and place or receive a call.

The technical prerequisite for the compatibility of the individual national networks is the GSM standard set by ETSI (European Telecommunications Standardisation Institute). It defines the processing of the digital signals at the interface, the division of the frequency band into channels, modulation and coding as well as the functions of the fixed radio stations and their regulation. In Germany these technical requirements were met with the activation of the D1 net. ETSI standardization is converted into the national standard by the German Electronics Commission in the DIN and the VDE (DKE).

Software for the complex GSM systems runs on supercomputers which in turn must be incorporated into the net. The nets are constructed in such a way that in the signal area every radio station can reach a maximum

number of subscribers simultaneously by mobile telephone. This is achieved by data reduction and by optimal utilization of the frequency bands by multiplex processing. The 137 frequencies in the 900-megaHertz band alloted to the GSM can each be utilized by eight subscribers. By multiple utilization of the frequencies at various points on the net an almost unlimited subscriber capacity is achieved. In the opinion of VDE-ITG, demands on mobile communications systems will continue to grow. Intelligent network functions will have to be developed for current nets in order to introduce a unified worldwide call number. Only then can the goal of "universal personal communication" be realized. Every subscriber should be able to access the network on any continent by card or telephone and be able to receive calls using the same call number in any country. By the year 2005 the European "Universal Mobile Telecommunication System" should be using an integrated system to provide the services of mobile radio nets which today exist side by side. Comparable efforts are being undertaken worldwide with the objective of creating a "Future Public Land Mobile Telecommunication System."

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